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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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BRIEFLY TOLD.

ACTION TAKEN BY THE SOCIETY OF GAS LIGHTING RESPECTING REPRESENTATION AT THE PROPOSED INTERNATIONAL CONGRESS OF GAS MEN.—The following communication from Col. F. S. Benson, Secretary of the Society of Gas Lighting, explains itself:

SOCIETY OF GAS LIGHTING,
OFFICE OF THE SECRETARY, Nov. 15, 1899.

At the last regular meeting of the Society, held in New York, Nov. 9, 1899, the committee who were appointed to reply to the letter of the Societe Technique de L'Industrie du Gaz en France, reported as follows:

Gentlemen—Your committee, appointed at the October meeting of the Society to consider a communication received from the Societe Technique de L'Industrie du Gaz en France, beg leave to report as follows:

The receipt of this communication, inviting our Society to participate in an International Congress of gas men, to be held in connection with the Paris Exposition early in September, 1900, has already been acknowledged by our President, who has also transmitted to the President of the French Society a copy of our list of membership.

We have been asked to suggest on our part topics for discussion at the proposed meeting. It seems to us that the very best subject for such discussion would be an international unit of light. The necessity for creating a standard measure of luminosity, which would be universally recognized, is beyond question. To day the parliamentary candle prevails in England and her colonies, as well as in our own country; the carcel lamp in France; the German Society candle and the Hefner amyl-acetat standard in Germany; while the pentane lamp begins to displace the candles.

We would ask all our members to consider the matter and suggest such other topics as they would deem proper for discussion at the contemplated meeting. Such suggestions should be handed to our President previous to Dec. 1 next, on which date we expect to make our final reply to the invitation.

Considering distance from home, time and expense connected with attendance upon the meeting, it would be naturally impossible to regularly appoint any of our members to represent the Society on this occasion. Should, however, any of our associates have the good fortune to be in Paris at that time, they should consider themselves our delegates to the Congress of gas men. Respectfully submitted,

ALEX. H. STRECKER,
E. G. LOVE,
ALFRED E. FORSTALL.

Mr. A. E. Forstall, Secretary of the American Gas Light Association, also quoted from a letter to the President of that Association from the President of the French Association, the following proposed series of subjects to be discussed at the International Congress:

International Congress in the Gas Industry in 1900—*Questions Proposed for Treatment up to this Date, Oct.* 15, 1899.

1. Explain from experiments especially made for this object, and from new experiments, the principal causes to which incandescence by gas is due.
2. The photometry of incandescent gas light.
3. What are the relations between the illuminating power of incandescent burners, all other things being equal, and the illuminating power and calorific power of the gas? Take, for example, a coal gas of which the value varies between 90 and 130 liters per carcel or thereabouts.
4. Settings of inclined retorts. The actual progress and the method of employing them in different countries. Their use in large works. Compare the capital for the first installation of settings of inclined retorts with that of settings of horizontal retorts; the economical result of this comparison reduced to a production of 1,000 cubic meters per day; the opportunity for their use in works of moderate size; a comparison of the results of this system with those of charging and discharging machines from both technical and economical points of view.
5. The means to be employe to avoid obstructions due to naphthalene.
6. The advantages and disadvantages of dry meters and wet meters.
7. The best means to be employed in increasing the use of gas in competition with electricity and petroleum.
8. Indication of the systems employed for interesting the stokers in the yield of gas from and the economical heating of the benches. (?)
9. Of the professional instruction in the gas industry, either to educate the foreman of works or of fitters, or for the special complementary education of the managers of works.

Special attention is called to the request of the Committee of the Society of Gas Lighting in reference to the limited date of receiving your suggestions for topics of discussion at the International Congress.

FRED. S. BENSON, Secretary.

DEATH OF MR. L. P. GEROULD.—We regret to have to announce the death of Mr. L. P. Gerould, for over two score years prominent in the gas profession of this country. Mr. Gerould died at a late hour of last Monday, and the funeral services were held the afternoon of last Friday. He was in his 65th year. In due time we will print the history of his life.

NOTES.—A correspondent in Nashville, Tenn., forwards the following: "In the ordinance introduced by Mr. John H. DeWitt, in the City Council of Nashville, which proposes a franchise for the Tennessee Gas and Coke Company, the grant is limited to 50 years, and the usual restrictions as to opening the streets are of course in evidence. The sections fixing the prices that may be charged for gas are as follows: 'Section 3. Under the permission and authority hereby granted, said grantees shall furnish a good commercial gas suitable for illuminating, heating and commercial purposes. If the said grantees shall furnish to the citizens of Nashville a good, commercial gas which, as furnished to every consumer within the city, shall, burning 5 cubic feet per hour, be capable of producing a light equal to that produced by 16 standard sperm candles, then the rate to be charged by said grantees for gas for private consumption shall not exceed $1 per 1,000 cubic feet, with 10 cents per 1,000 cubic feet discount for prompt payment, 90 cents net; and for each candle power over and above 16, as above provided, said grantees shall be entitled to add 5 cents to such prices for each 1,000 cubic feet, the maximum price, however, in no event to exceed $1.35 for each 1,000 cubic feet, with 10 cents per 1,000 cubic feet discount for prompt payment, making a maximum net price of $1.25 per 1.000 cubic feet. Sec. 4. The rate to be charged by said grantees to the city of Nashville for gas for all purposes shall not exceed one-half the net cost of gas furnished to private consumers.' The proposition in respect of an increasing selling scale, keeping pace with each candle rise in illuminating value above the 16-candle basis is quite ingenuous, although one can hardly say it is remarkably ingenious."——The extension of the furnace building for the Raritan Copper Works, Perth Amboy, N. J., will be furnished by the Berlin Iron Bridge Company, of East Berlin, Conn. The Bridge Company is also under contract to furnish a steel boiler house for the Ansonia (Conn.) Brass and Copper Company. The building will be covered with the Bridge Company's patent anti-condensation roof covering.——"R. W. M.," writing from Terre Haute, Ind., says that the people behind the application for a franchise for an opposition gas company in Terre Haute are Messrs. Osborne and Martin and Mr. Henry Miller, of Terre Haute. They propose to supply gas at a maximum rate of $1 per 1,000 cubic feet, with a discount of 15 cents per 1,000. The petition is now before the Board of Public Works, which body must pass upon it before it goes to the Council. Our correspondent adds: "Even if the Board of Public Works does pass the ordinance on to the Council, I believe the latter would negative the scheme, for the existing Cas Company stands very well with the people and with the authorities."——The Pacific Gas Improvement Company has paid to Tax Collector Sheehan, of San Francisco, the sum of $16,300, the payment being accompanied by a protest to the effect that the assessment of the corporation is void as to its franchise in the sum of $1,579,721, which it is alleged is $1,000,000 in excess of the full cash value of the franchise. The claim is founded on the ground that the sum assessed is excessive, and that it is at a greater rate than the assessment of other similar franchises.——Mr. Charles C. Johnson, formerly prominent in the management of the Norwich City (Conn.) Gas Company, died at his home in Norwich, the evening of November 17th. We are indebted to Mr. S. A. Taylor for this summary of Mr. Johnson's career: "Mr. Johnson was born in Jewett City, Conn., March 21, 1831. His parents removed to Norwich in the same year. As a youth he attended the Norwich schools and afterwards the Academy at Woodstock. His early business life was passed in New York. In 1866 he resigned his position with the Illinois Central Railroad, being located in its New York offices, and returned to Norwich, where he assumed the duties of Treasurer of the Norwich and New York Transportation Company. Later he was elected Treasurer of the Norwich City Gas Company and subsequently was chosen its President. He managed its affairs with conservatism and success, retiring from its service when the Company's properties were purchased a few years ago by the present owners. Mr. Johnson had a keen financial instinct and closed out the liquidation of the old Jewett City National Bank. Mr. Johnson was elected President of the Norwich National Bank, a position which had been held by his father, and closed up its affairs when it was consolidated with the Thames National Bank. He was for many years a Trustee of the Norwich Savings Society. He was a member of the Park Congregational Church. Personally, Mr. Johnson was of a retiring disposition, and in all his business relations he was noted for his strict integrity. He was essentially a home man and never entered largely into public affairs. In 1863 he married Miss Julia Cleveland White, of New York, who died May 26, 1893. A son and a daughter survive him."——The Union Light and Power Company, of Salt Lake City, Utah, is installing a coal gas plant up to a daily output of 200,000 cubic feet.——Mr. Thaddeus H. Ivey, for many years Secretary and Treasurer of the Lynchburg (Va.) Gas Company (he retired some time ago from such service because of failing health), died at his home in Lynchburg the morning of November 19th. He was in his 79th year. ——The West Conshohocken Gas Light Company, "to furnish gas for light only" in the borough of West Conshohocken, Pa., has been organized by Messrs. James Moir, Ellbridge McFarland, Horace C. Jones, John C. Tracey and Henry M. Tracey.

Gas Supply by Automatic Meter.

[A paper read by MR. H. O. ELDRIDGE, of Tottenham, England, at the last meeting of the Southern District Association of Gas Engineers and Managers; with the discussion that ensued.]

At the request of your President, I shall endeavor in this paper to lay before the Association some information, and to relate some of the difficulties, troubles and successes we have experienced in the commencement and continuation of gas supply by automatic meter. I do not suppose much of the information will be new, or of a nature greatly different from that encountered by members of the Association in the promotion of work of this description.

The opening attempt by my Company was made in 1893, at the end of which year we had about 70 meters in use. At the close of the present year (1899) the number will exceed 8,000; ours being, I believe, the first case in which the number of slot meters has exceeded the total of ordinary consumers. Our district is well situated for automatic gas supply; being only a few miles north of London, and well furnished with a service of cheap workmen's trains. The builders find that, no matter how fast houses are erected, would-be tenants apply, as occupiers, before the first brick is laid. They do not build here in terraces or streets, but lay out enormous estates at once, and soon convert what were smiling green fields to row upon row of bricks and mortar, all consisting of cottage property or small shops, for which the slot meters are suitable, and are eagerly applied for. By a little judicious canvassing, fully 75 per cent. of these occupiers can be induced to burn gas. In most cases, the house is inhabited by only one family; and there is not the trouble and continual expense to the Company entailed where lodgers are supplied. Though extending so fast, we have in this district still vast tracts of market fields and agricultural lands that leave ample scope for time to come.

It may be of interest to state first the particulars of our last year's collection (1898). But I will mention, in parenthesis, that we are charging for ordinary supply 3s. per 1,000 cubic feet; and by slot meter we furnish 22 cubic feet per penny. Many of our first meters were set at 3s. 8d. per 1,000 cubic feet, or 22½ feet per penny; and a large proportion of these are still in use. The gas consumption for the year was 85,800,000 cubic feet; the number of meters was 6,860; and the money collected and paid to the bank, £16,130. This gives averages as follows:

Gas per meter.....	12,500 cubic feet.
Money per meter.....	£2 6s. 10d.
Price per 1,000 cubic feet.....	3s. 9d.

Taking the total collection—£16,130—as a basis of calculation, £12,870 is taken for cost of gas at 3s. per 1,000 cubic feet, and £1,029 for meter rents at 3s. per year (which is our charge for an ordinary 3 light meter), leaving £2,231 for hire of fittings and additional slot charges. This equals about 6s. 6d. per year or 1¼d. per week for each house. With 12,500 cubic feet registered on an average by each meter, and paid for at the rate of 3s. 9d. per 1,000 cubic feet, the excess payment, after deducting gas at the ordinary price (3s.), is 9s. 4d. for each house. I have taken the excess cost of fixing slot meter and fittings above ordinary to be—

Labor, pipes and fittings.....	£2	0	0
Service.....	0	10	0
Slot attachment.....	0	18	0
Total.....	£3	8	0

The 10s. stated for service does not cover the cost, but represents the additional loss as compared with ordinary meters, the cost of the services to which are partly paid by the consumers. The 9s. 4d. yearly has, therefore, to provide—

(*a*) The extra cost of collecting and booking small accounts.
(*b*) Interest on £3 8s. capital, which, at 4 per cent., amounts to 2s. 9d.
(*c*) Rent of meter, which, for ordinary 3 light, is charged 3s.
(*d*) The attention to, and responsibility for, internal fittings, flexible tubes, etc., and the upkeep of the same.
(*e*) Finally, whatever sum is thought advisable to write off the value of the fittings, etc., from year to year.

This calculation of cost of supply and erection is based only on the excess cost for gas by slot meters, and is in every way independent of distribution in the ordinary manner. On the question of cost of collection and inspection I shall speak later.

One of the first causes of success in automatic gas supply is the careful selection of the class of property to be accepted. The ideal is the happy medium between villas and slums. We only give one description of fittings, and is not much variety; and houses of the better class

—say, ranging from £30 rental upwards—are not generally profitable. When we have been induced to fit these up for a consumer, he has often been dissatisfied after the work is completed. For good and lofty rooms better fittings than we supply are required ; and although one consumer may be satisfied, on a change in the tenancy of the house we have been requested (sometimes not at all politely) to clear them away. Of course, loss is then incurred.

The best kind of house is undoubtedly that purchased, or being purchased, by the tenant, and inhabited by clerks, mechanics or skilled laborers. These are not likely to remove, as a large proportion of our customers are constantly doing. They have an interest in the house and in the keeping of it in repair; and when once it is nicely completed, they will turn out excellent consumers, and give very little trouble. Workshops cannot be supplied satisfactorily by slot meter. The gas is not required as a rule except for a month or two in mid-winter ; and during the remainder of the year the meter and fittings produce no profit, and, being in the way, are liable to damage. Orders for lighting stables should also be refused. The consumption is always small, and the fittings likely to deteriorate. An eminent solicitor living in our district had his stables supplied by slot meter, and the money collected during a period of two years amounted to the magnificent sum of one shilling and six pence. Small shops in our neighborhood are good and large consumers—but troublesome, as they often change hands, and each incoming tenant requires alterations according to the nature of his business. On the other hand, when a good business man finds his shop a success, he generally prefers to change the system for a supply by ordinary meter.

It is becoming usual now, in closely populated districts, to erect suites of rooms in flats one above another, each portion a distinct tenement, but generally entered by a stairway or passage common to all. The automatic gas supply is suitable and easily furnished to such buildings ; but care should be taken to place the service to all levels before the building is completed, and each meter should be placed, not in the common passage, where it is likely to be tampered with, but under the protection of the responsible consumer.

The fittings we supply consist of a 2 light chandelier, with cup-and-ball joint, but without hydraulic slide, and three pendants or brackets as required ; one having an extra cock for the flexible tube and boiling burner. The inspector who accepts the order carries a numbered photograph illustrating the fittings, to enable the customers to select from. He settles the position of the fixtures, and gets signatures to the consumer's contract, and the consent of landlord to fix and remove the fittings if required. The orders to place gas fittings, after the meter is fixed by the Company's workmen, are handed to our contractors, who complete the fitting of each house at the agreed rate of one guinea per house for labor, pipes, etc., after which the work is examined, and if satisfactory the accounts are passed for payment.

As an experiment, our Company fixed without rent or charge, and in connection with slot meters, about 50 small gas cooking ranges, to ascertain if the increased consumption of gas would warrant any further outlay in the same direction. I think that the subject of gas cookers, with the different conditions under which they are provided by gas companies, is a question that up to the present has hardly received the attention it deserves. This matter may be partially beyond the scope of my paper ; but stating the result of our experiment, and the opinion formed therefrom, will, I trust, call forth some very valuable remarks as the experiences of others on this subject.

Our experiment was a dismal failure. The excess consumption on an average was only about 2,000 cubic feet per annum where the free cooker was placed, showing a return of 1s. 6d. in the extra or "slot" profit. The expense of obtaining and fixing these was over £2 each. Interest on capital alone would, therefore, more than absorb any profit from the increased consumption of gas, and leave nothing for depreciation, repairs and changes. We have made no more experiments in this direction.

I cannot but compliment the manufacturers of gas cooking stoves on the perfection which they have attained, and the wonderful economy with which the work is performed. But this very economy is an advantage in which the gas companies have no share. They bear all the heavy original outlay in purchasing and fixing, and afterwards the constant attention and repairing required ; while the rental charges in many cases are scarcely sufficient to pay for the depreciation of a machine at once fragile and liable to injury. Gas cooking stoves have so thoroughly established their utility, and are so generally recognized as the cheapest and most reliable means of domestic cooking, that some alterations in the present systems, whereby the expense is more equally divided, should not be a matter of great difficulty.

Under the old system of collection, the boxes are emptied twice each quarter, and the proceeds paid directly into banks, of which we have eight branches in our district ; each day's work being compared with the bank slips, so that a good check is obtained on the collector and his collection lists. The necessity of paying in before closing of banks, however, makes the afternoon a short one ; and fifty accounts were reckoned a good day's work. By this system, the collector had no cash to take home or leave at the office after his day's work was done.

Wishing to increase the number of collections each day, we have lately allowed some of our best men the opportunity to see what they could do at collecting on piecework ; the price paid being ¾d. per meter. Each man is given a district of about 800 accounts ; and he is allowed to work his own hours, but is held responsible for the safety and correctness of his work. This has effected a great saving. The old system cost more than 8s. per 100 accounts. Under the new, the price is 6s. 3d. The collectors like the new plan, as it enables them, by working longer hours, to increase the amount of their wages considerably—especially where the banks are conveniently situated, and the neighborhood thickly populated.

The collectors are provided with strong paper bags for coppers ; each bag holding 5s., and stamped with the amount and the Company's name. It is a fact that for the last four years the banks have accepted these bags at the stamped value, and have supplied their customers with them without a single case in which the amount has been disputed.

This collecting work is heavy manual labor, and needs strong and vigorous men. Ten pounds worth of coppers, with collecting bags and books, will weigh close on 56 pounds. The work is often dirty and disagreeable. Men are brought into contact with a good many family affairs that are usually kept in the background—with dirt, sickness and sometimes death.

I have endeavored, in this paper, to give some outlines of the conditions under which my Company have carried this now important branch of gas engineering to a successful issue. Many others, probably working in the same direction, have obtained better results ; but before concluding I should like to remark on the satisfaction expressed by our customers, when they have once got acquainted with, and accustomed to, the system of lighting their houses by automatic gas supply. They seem almost to dread a return to their old plan of paraffine lamps, with the accompanying dangers and disagreeable smells. The owners of property and the agents who represent them are almost without exception in favor of our supply. They willingly assist by giving us notice of changes and removals. They consider the value of their property is enhanced, and the class of their tenants improved, by the introduction of the system. The houses are kept in better condition ; and the constant inspection of collectors in uniform, who call so many times during the year, and who are necessarily invited into the interior of the house, must have its effect in bettering the conditions of the inhabitants. For where light is, cleanliness must follow and crime cannot hide ; for the dark places of the earth are the habitations of cruelty.

Discussion.

The Chairman observed that the paper contained a great deal of interesting information ; and some of it might be very useful. He was sorry to hear of the experience at Tottenham in regard to the hiring out of cookers, because he believed it was quite opposed to the experience of a good many other companies. As to the remark Mr. Eldridge made respecting the stove makers, he (the Chairman) thought he could quite endorse it. At all events those buying gas stoves should be careful in making a selection. Some stoves were got up in a very trumpery way, and cost a great deal for repair at a very early stage of their use.

Mr. J. W. Helps (Croydon) said he should like to thank Mr. Eldridge for having so kindly come forward to assist the Association with his paper. At the same time, Mr. Eidridge would excuse him saying that he felt perhaps a little disappointed at the manner in which he had treated the subject, because it seemed to him it really resolved itself naturally into a question of £ s. d. What they wanted to know was whether this system, under the conditions in which it was worked in connection with their various companies, really paid its way. If the author, instead of giving them the figures in the way he had done, had worked them out at so much per 1,000 cubic feet, the members could, having their own figures at their fingers' ends, have compared what they were doing in their own several towns with what was being done at Tottenham. He knew that it was the custom generally, when looking at the vast growth of the prepayment system, to consider it simply from the point of view of the number of consumers one had ; but when one looked at it from the amount of gas, or rather the per-

centage which the quantity of gas used under the prepayment system bore to the total quantity, he thought then they would be somewhat surprised at the smallness of the proportion. At Croydon, where the system has been in use ten years this month (in the town itself it was the prepayment system, and the automatic was only in use in one small district), he found that, in the year ending June 30, 1898, the total quantity of gas sold under the prepayment and automatic systems was only something like 13 per cent. of the total. This was accounted for by the fact that, while the average amount of gas used by the consumer under the ordinary system was 54,380 cubic feet, that used under the prepayment system was 18,311 cubic feet, and that used under the automatic system only 16,000 cubic feet. They had had a good opportunity of comparing the two systems—the prepayment, whereby an amount of gas was turned on and paid for and a receipt given by the inspector at the time of his visit, and the penny-in-the-slot, or automatic system, to which Mr. Eldridge had more particularly alluded. In Croydon, under the prepayment system, they charged a regular rent of 2d. a week for the fittings, and under the automatic system the extra charge was 9d. per 1,000 cubic feet. If the members would bear with him for a moment, he might point out how, from a pecuniary point of view, the three systems compared. In the first case, he found that the total amount of money which, in Croydon, was laid out on an ordinary consumer—that was, the capital outlay—was £2 18s. 5d. The gross amount there received for gas per 1,000 cubic feet was 2s. 9.6d., including meter rent. The cost of collection, 10 per cent. depreciation, and the various other charges (bad debts and inspectors) totalled to 2.28d., leaving 2s. 7.32d. as the net amount received for gas—that was, with the charge of 2s. 8d. per 1,000 cubic feet, only 0.68d. less than the actual amount charged. With the prepayment system, they found the total capital charge, in Croydon, exclusive of a stove (because, the 2d. being a regular charge, and having nothing to do with the gas stove, they could fairly charge the ordinary rent for the stove, which could not be done under the automatic system), was £4 9s. 9d. The gross amount received for gas, including rent, was 3s. 2.54d. The total charges for collection, 10 per cent. depreciation, inspectors, etc., came to 8.79d., giving them a net amount of 2s. 5.75d.; or, in other words, they received 2.25d. less than the price of gas—viz., 2s. 8d. per 1,000 cubic feet. Thus, they were actually supplying gas to the prepayment consumer in Croydon at something like 1½d. less than to the ordinary consumer. Then they came to the automatic system, which was in use in the Carshalton district. There the capital charge, including a stove, came to £7 8s. 5d.; the stove in some cases being a large one, and sometimes costing as much as £5. They did not limit the cost of them, because their experience was different from Mr. Eldridge's. They found that the stove did very considerably increase the amount of gas used per consumer. In that district, the gross charge for gas under the automatic system was 4s. 2d. per 1,000 cubic feet. Taking from this the various charges—1s. 2.15d.—left 2s. 11.85d.; and the ordinary price of gas in Carshalton being 3s. 5d., the amount received from the automatic consumers was 5.15d. less than they were charging the ordinary consumers. The cost deducted from the gross figure was rather raised by the fact that he had taken 10 per cent. depreciation on a very large sum; but if he took the cost of the cooker away, it would be found that, practically speaking, it made a difference of about 4½d. upon the price charged to the automatic consumer, which was exactly the same as that charged to the ordinary consumer. But if they had not the stove, they would not have the gas; and, therefore, the divisor in that case would be smaller, and probably would bring it to just the same. This went to prove the fact that really the automatic consumer was treated rather too leniently. The 9d. per 1,000 cubic feet did not really pay, and the ordinary consumers suffered accordingly. This did not appear to him to be quite fair. Going again to the question of stoves, he said it was a very important one, and one in which they were now taking a great deal of interest in Croydon, with the view of deciding whether it was fair to charge any rent to the automatic consumer for the stove. He had taken out at random two instances that morning. In one case a consumer on the automatic system in Carshalton was using, on an average, 59,000 cubic feet of gas in a year. Now, if they took these figures, and examined them carefully, it would be found that, deducting all charges from this man's account, he was paying the Company full rent for everything, and putting into their pockets 15s. besides, because they were charging him 9d. per 1,000 cubic feet on the whole of the 59,000 cubic feet. Taking the case of another man only consuming 10,000 cubic feet a year, they found the Company were out of pocket to the extent of 5s. 6d. If, therefore, they went on charging the large consumer a rent for his stove, they would be making him pay twice over. He (Mr. Helps) would like to find out whether it was not possible to adopt some sliding scale method, and not always take from the consumer 9d. per 1,000 cubic feet, if he used a large quantity of gas. It seemed unfair to do so; and what he would like would be some system of regulating the extra charge per 1,000 cubic feet according to the amount of gas burned. With their prepayment system in Croydon, charging regularly a rent of 2d. per week, it did not matter whether or not they charged rent for the stove. It was perfectly fair, one way or the other; and it was simply a matter for the Company to decide. He made these few remarks because he wished to point out that so far this prepayment system had been woefully neglected. He believed, having had the two systems working side by side, that this one was absolutely the cheaper. In Croydon 1.79d. per 1,000 cubic feet covered cost of collection, while in Carshalton district it cost 1.86d. It was usually thought that one of the great disadvantages of the prepayment system was that the cost of collection was so much more than in the case of the automatic meters; but these figures rather disproved this. He wished to stand somewhat as a champion of the prepayment system, and he would ask those who were thinking of adopting one or other of the systems, to consider whether the prepayment system was not worthy of adoption in some towns.

Mr. W. E. Price (Hampton Wick) said he could quite bear out what Mr. Helps had stated with reference to cooking stoves; but in his district they, of course, had nothing like the quantity fixed that there were in Croydon. His experience was that, unless the slot consumer had a cooker, he was not worth having. The slot consumers were charged the same proportion as rent, and, with the cooker, they found that, as Mr. Helps has said, it did not work out quite fair to the big consumer. In some cases the rent of the meter and cooker came too far and above what it should do; but it was difficult to know what to do under the circumstances. It hardly seemed satisfactory to have more than one price under the coin meter system. It would cause great dissatisfaction, and besides they could not very well set the meter at one point for one consumer, who would probably disappear in a few months and be followed by another whose consumption would necessitate a change again. He had not had any experience of the prepayment system as in use at Croydon, but his objection to it was an objection that had been raised by the consumers using the shilling-in-the-slot meter. Where there had been a large amount of gas used, he had visited the consumer who had a shilling-in-the-slot meter, and he objected to it—his reason being that he could not control the consumption, and consequently did not obtain that economy with the shilling slot that he was able to secure with the penny slot, as he was unable to check the servant. It seemed to him (Mr. Price) that the prepayment system was even worse in this respect, because he took it that a man on the prepayment system would pay more than a shilling on each collection, and there was thus practically no check on the servants. In his district the meters were in use for this object as much as for anything else. It was unlike Tottenham in that it was a residential district mainly, and had practically no laboring class population. Therefore, for the reason he had mentioned, the prepayment system would be much objected to by his class of consumers.

Mr. F. W. Cross (Lea Bridge) said if their esteemed President had been with them that day, he would no doubt have put in a word, following the remarks of Mr. Helps and Mr. Price, that would have explained the statement made by Mr. Eldridge in regard to the use of stoves. His (Mr. Cross's) district bordered on that of the Tottenham Company, and he could quite believe Mr. Eldridge when he said that stoves were not suitable there in connection with the slot meter system. The class of people who used these slot meters there was quite different to what would be found in Mr. Price's neighborhood, where they would take the stoves. He thought in his own district stoves would not be suitable, because he would get exactly the same class of consumer as they had in Tottenham. However, from his present experience, he thought he should do better by leaving stoves alone, and the only thing he would push with his consumers would be boiling rings. He believed these were the most suitable, and perhaps he might put in a small griller for use in the early mornings. He thought the point as to the class of consumer should be borne in mind in considering Mr. Eldridge's paper, and it should not be said that, because Mr. Eldridge had found that stoves did not pay, they would not pay anywhere else. There was only one little point he should like to put to Mr. Eldridge. He said: "On the other hand, when a good business man finds his shop a success, he generally prefers to change the system for a supply by ordinary meter." Now as he (Mr. Cross) had said, he had not gone into the slot meter business. With an increase of 20 to 25 per cent. per annum, he thought he was better without it. They had, however,

a system of monthly supply and collection, and they furnished fittings on hire and charged a rental of so much per week. He should like to know from Mr. Eldridge what he did in regard to the fittings left in houses when a consumer changed to the ordinary supply.

Mr. W. B. Randall (Waltham Cross) said he noticed the author mentioned that, to facilitate collection, they had started a piece work system. It occurred to him (Mr. Randall) that this was possibly liable to be false economy, for the reason that, in collecting from slot meters, there were oftentimes little, trivial things that could be attended to by the slot meter collector. But if he was on piece work, his natural inclination would be to make marginal notes in his book, and then a fitter would have to be sent to attend to them, and this would add to the cost of the system. He had had considerable experience of slot meters, and, like Mr. Helps, he found stoves did pay them very well indeed. They were in the position of having now 140 to 150 per cent. more automatic meters than ordinary ones, and he was sure their increase of consumption had been very largely helped, both in the automatics and ordinary meters, by the cookers. They found in many cases where people started with the automatic meter, that they changed, after a time, to the ordinary meter, and it caused an introduction in this way which otherwise they might not have had. He found that a boiling ring, too, frequently led to the adoption of a stove. The consumer wanted greater facilities, and then they supplied him with a stove. The stoves had answered very well indeed. Naturally the character of the district had to be considered. What might be unsuitable in Croydon was very suitable in the vicinity of Tottenham, and where there was an artisan population the automatic system was undoubtedly a great success.

Mr. F. G. Cockey (Newport, I. of W.) said, as contrasted with Mr. Humphrys' paper, this contribution of Mr. Eldridge's was a most interesting one, and bristled with matter upon which every member would possibly form a different opinion from his own experience. Personally, with reference to the remarks about cookers, he had had to fit up houses on the slot system as opposed to the prepayment system Mr. Helps had mentioned, and he had come to the conclusion that the cooker was a necessary part of the fittings—that, without a cooker, the slot system was hardly worth having. He might say they confined themselves to one pattern of cooker—small and strongly made—but it was rather early to speak about what the life of the cookers would be, because he had not seen one perceptibly the worse for wear, except for dirt. Speaking of cookers of larger size, even after 10 or 12 years' use, he had not seen one worn out. Although he had not been able to get figures to show what the maintenance worked out at, he was quite convinced it would be very small. There was a question that had presented itself to him, and no doubt to others, as to how these cookers and other parts of the free fittings should be treated—whether a portion of them should be charged to capital. It seemed to him to have rather an important bearing upon the apportionment of the excess charged on the slot meters. His idea was that the cookers, which were permanent and durable fittings, should be charged to capital. In his own case, they charged the meter and services direct to capital, and he thought the cookers should also be charged to capital. He took it that the amount of maintenance required by them would be a very small addition to the ordinary maintenance charges to revenue. With reference to Mr. Helps's remarks as to his experience at Croydon, one had, of course, to take into consideration the local circumstances. Croydon was one of those places where the majority of the people earned good money, and it was probable the prepayment consumers readily planked down 5s. or even 6s. [Mr. Helps: No; 1s. or 1s. 2d.] But in a town like his own, where the population was decidedly poor, it was very difficult to get people to pay for anything in advance. They were perfectly willing to pay a penny, but they would not pay out a shilling if they could help it. But this, of course, was a matter of local circumstance. As to the question of limiting the size of houses fitted up, their limitation was houses of £20 rental.

Mr. W. B. Mimmack (St. Mary Cray), speaking with an experience of 500 automatic meters, said he could not help thinking that the whole question was one of margin. Automatic meters could be made to pay if a sufficient margin was left for the purpose. Some years ago, 8d. or 9d. was suggested as a figure that was ample to cover everything, but it was not sufficient if cookers were put in. Experience had proved that the automatic system without a cooker was not worth having. In his district the cooker was the one thing that was necessary to make the automatic installations (if he might call them so) a success. But he found that the cookers required a good deal of attention, and every now and then they saw that they were not used so well as they should be. The cookers had then to be taken out and sent up to the makers, in order that they might be repaired. This entailed a considerable outlay, and therefore, in order to cover what looked like being rather greater expense than was generally anticipated, they allowed a larger margin than was usually adopted. He thought Mr. Helps said that he found the automatic consumer was being treated to the tune of 5d. per 1,000 cubic feet better than the ordinary consumer. He (Mr. Mimmack) found that this was just about the figure—that was, between 9d. and 1s. 2d. was the figure that should be taken. In his case the ordinary consumers were charged 3s. 10d per 1,000 cubic feet, and the automatic consumers 5s., and they found they had only just sufficient to cover the expense of depreciation and the interest on the money laid out. He might say, too, when they first started they had a rush of undesirable applicants—people whom they felt sure would never make the system a success. They, therefore, cast about to find a means of choking off the worst, and they ultimately decided to fix an application fee—only a low one—and to make a distinction between those who were applying simply for lighting and those who were asking for cookers, because the Company were anxious that they should take care of the cookers, and not go in for them when they only wanted a light in the kitchen or scullery. Therefore it was decided to charge a fee of 1s. to applicants who did not require a cooker, and 2s. 6d. to those who did. This had acted in a most satisfactory manner, and the results they were getting from the consumers who paid 2s. 6d. were infinitely better than the results they obtained before the application fee.

Mr. W. F. Broadberry (New Southgate) asked Mr. Eldridge how he arrived at the excess consumption of 2,000 cubic feet per stove. He happened to be managing a works on the borders of Tottenham, and the paper was therefore of particular interest to him. He understood that at Tottenham they simply fixed 50 stoves as an experiment, and they did not really know what these particular meters would have done without the stoves. It seemed to him that, if they had put the 50 stoves on to customers who were already burning gas through slot meters, and then compared the consumption of gas under the two conditions, Mr. Eldridge's figures would have gone a bit further than they did at the present time. At Colney Hatch they had been putting out automatic meters for four or five years, and they fixed cookers as well. In most cases he found that the consumption by them was more than 2,000 cubic feet; it was, he thought, much nearer 10,000 feet. Regarding the difficulty as to the size of the stove, they only in the ordinary way used a small stove, for which they paid the makers about 25s. These stoves met their own requirements and those of their consumers, and not many of them wanted a larger one. They also let stoves in the ordinary way, and made a charge of 2s. to 3s. 6d. a quarter. If a slot consumer wanted a larger stove, they told him that they regarded his stove as worth 1s. a quarter, and if he had the size rented at 3s. 6d., he must pay 2s. 6d. more for it. The consumer would do so, and they got over the difficulty.

Mr. F. G. Dexter (Winchester) said, with reference to the point raised by Mr. Price as to the difficulty of introducing shilling slot meters instead of penny ones, that was not his (Mr. Dexter's) experience at all. He had had cases where the consumers had had some difficulty in placing in the meters the number of pennies they required to, and they had applied to the Company for shilling slot meters in order to save trouble. This point showed how impossible it was to always apply the experience of one man to another's case, and particularly was this evident in the question raised by Mr. Helps. He (Mr. Dexter) noticed that three times already it had been stated during the discussion that prepayment consumers were not worth having, unless they had a cooking stove. He recognized this point so strongly at the commencement of their slot meter career about five years ago, that he had done his best to get nothing but cooker consumers, and four fifths of those he had were only cooker consumers and without lights at all. They paid exceedingly well. As to the objection raised by Mr. Helps regarding consumers having to pay a heavier rate for the cooking stoves by the automatic system in consequence of the quantity of gas being set at so many feet per penny, if they happened to set the meter at such a rate that the rental was being practically paid twice or three times over, they were doing that man an injustice. At the time he (Mr. Dexter) occupied the chair of the South West Association, he distinctly mentioned in his Inaugural Address that he strongly objected to the system of an extra charge for prepayment consumers at all, and he had worked entirely upon the principle of having the prepayment consumers on the same rates as the ordinary consumers, taking into consideration the amount of rent the latter had to pay for their meters, and setting the slot meters at the number of feet per penny that they judged would pay the rent. If it was found that they had not allowed quite enough, the meter was corrected, and if they had allowed too

much, it was also corrected, and at the end of a quarter, they returned whatever surplus there might be to the consumer. Cooker rents were paid quarter by quarter to the inspector as he went round, and the consumers were allowed to have any sized cooker they chose, from 1s. to 4s. 6d. By these means every slot consumer was placed in exactly the same position as the ordinary ones. He paid no more and no less, so far as they were able to manage it, than the ordinary consumer.

Mr. D. Irving said that whatever differences of opinion there might be—and there were evidently great differences of opinion and great differences of experience with regard to slot meters—he thought they were all agreed that the Tottenham Company had been very successful in the letting out of these slot meters. So far as he was able to judge, the whole matter resolved itself into the question: Does it pay? He ventured to think that the system of fitting up lights and cookers and letting out slot meters, as it stood by itself on the figures given, did not in the long run pay. If they took the figures, they worked out something like this: There was an income of £16,000, from which the gas at the ordinary rate was taken and the meter rents deducted, leaving the sum of £2,231 to cover the interest on the large capital expenditure, the extra cost of working (because he thought there must, without any doubt, be an extra cost), the wear and tear and renewals, and some amount of depreciation ought to come in. Now he ventured to think, upon the number of meters mentioned in the paper, the sum of money available would not cover the items he had named, presuming they allowed 5 per cent. interest. On the other hand, it must be clearly understood that there was a large profit accruing to the Tottenham Company from the sale of the 85 million cubic feet of gas at 3s. per 1,000 feet. This profit, assuming that the system was made to pay its way—that was, that the amount of extra charge was sufficient to cover the cost of interest, maintenance, etc. (and maintenance must be understood in the sense in which it was understood in gas accounts—that was, to cover depreciation), then the Tottenham Gas Company stood well with regard to the system, because in the ordinary way they would have between £2,000 and £3,000 profit from the gas. Therefore this system of prepayment meters was worth carrying out. The only thing was to take care that they did not unduly increase the capital, and he thought every company going into the system to the extent that the Tottenham Company had done should clearly and definitely set aside a certain annual amount to wipe off the capital in a fixed period. He did not think any manager or official of any company would be justified in entering into this large capital expenditure without doing something to wipe it off.

Mr. Eldridge, in reply, said he stated distinctly in the paper that his calculations were based on the excess price of gas only, and not on the 3s. per 1,000 cubic feet. The Directors had already transferred from capital to a suspense account the cost of all the fittings fixed. Where a consumer changed from a slot to an ordinary meter, they generally got him to pay a rental of 2d. per week, or buy the fittings at a reduced rate. They never allowed the collectors to do anything in the way of repairs, proper officials being sent, on a report being made to the office. With regard to the 50 cookers, they made the comparison with the average of 50 consumers without cookers; and they so arrived at the 2,000 cubic feet excess consumption. Speaking of cooking stoves, they had had to revise their list of charges. They had had them as low as 1s. 3d. per quarter; now the lowest was 2s. 3d. per quarter—the list price running from 9s. to 12s., 15s. and 18s. per annum.

Mr. Irving thought the consumption of 12,500 feet per meter was above the average, with the exception of Croydon.

Mr. Dexter said his average was 18,000 feet.

Mr. Botley—And mine is also very much more.

Mr. Irving remarked that in a return published last year the average did not reach 10,000 cubic feet.

[From *Engineering*.—Continued from page 849.]

American Competition.—No. IX.

By Mr. William Metcalf, Pittsburg, Pa.

Some time ago I was invited by you to say why, in my opinion, Americans can compete with English manufacturers, and to state in what way American methods are more economical, and how much their raw materials are cheaper than the English.

I do not feel able to answer such questions directly, and can think of no better way to interest your readers than to give a history of a crucible steel concern, and to leave it to them to draw their own conclusions. In 1865 three young men, a Sheffield lad, a hammerman by trade, a mechanical engineer and a business man, the latter two Americans, built 12 melting holes and 3 steam hammers; in January, 1868, they were joined by another young engineer, and 12 melting holes and one 12 inch train of rolls were added to the plant. The total invested capital was $100,000.

About 1870 the Siemens regenerative furnace was introduced into Pittsburg, and shortly after, these young men tried one and found it efficient and economical. In less than three years they added more furnaces, until they had invested in furnaces and royalties $50,000, without adding anything to the capacity of the plant except the equivalent of 12 melting holes.

In about five years the saving in fuel wiped out the $50,000, so that the change had then cost nothing.

There was an enormous gain in efficiency and in the behavior of the men that could not be figured in money; it was a great advantage, however, and it continues to this day. It was soon found that the best American iron of that day would not quite make as good steel as the best Sheffield brands; then one of the young men went over to Sweden, only to be told that it was impossible to buy a pound of the best Dannemora iron; the Sheffield steelmen had bought it all for five years, with an option on the next five years, the owners being bound by strict contracts not to make any more iron nor to sell any ore. After a thorough visit to the mines and forges, our Yankee went back to Stockholm and told his iron merchants that the chain seemed to be complete, but that there was a link loose, and he wanted them to find it. There were many owners of the mines, and one obscure owner with a disused forge had a right to some of that ore, and he wanted them to find that man and get him to make them some iron.

At first he was laughed at heartily, and then promised that a search should be made for his mythical man and forge. Within a month of his return home word came that the man with a forge had been found, and that for a three years' contract he would furnish an iron guaranteed to be equal to the famous double bullet hoops L or other highest class brands. The contract was made. At the end of three years it was continued and the quantity was increased; at the end of the second three years all of the great Dannemora brands, with perhaps one exception, were for sale in the open market.

Our young Yankee found the steel works of Sheffield as hermetically sealed as the Dannemora business, the holders of the keys being apparently unconscious that their most expert workmen were swarming over to the States, and that many of them were offering for sale copies of their mixtures for all of their brands. Our young men did not buy the mixtures, they bought the iron and employed the men. In 1876, Dr. C. W. Siemens visited our Yankee in Pittsburg and examined his plant; he noticed some nice clean nut coal on the producers and asked its cost—75 cents, or 3s. a ton, astonished him. He next asked the quality and price of some iron he saw, and was told that it was about equal in quality to the ordinary grades of Swedish melting iron and cost about £9 a ton where it lay. Then he asked, "What do you want of a tariff when you have such splendid cheap fuel and good cheap iron?" He was told that it was for defence, and out of pure benevolence and love for our British cousins; for defence because the cheapest and best standing army was a nation of well paid and contented citizens; for benevolence, because if the tariff were removed and our men were brought to the level of Sheffield wages, Sheffield would starve, and we did not want to starve our relatives. At the close of his visit Dr. Siemens placed his hand on our Yankee's shoulder, a strange and rather sad expression was on his face, and he said, "My young friend, I have been very much interested to day. It pains me far more than I can tell you to have to come more than 3,000 miles from my home to find the best application of principles that I have spent my whole life in developing. Your plant is 50 years ahead of anything in Sheffield."

In regard to the workmen, it is safe to say that a more hidebound set of men never left England. "You mustn't do this;" and "you cannot do that;" this is impossible, and such a thing as that "was never heard of," etc. After ten years or so you might ask the most stubborn of them to do the most apparently impossible thing, and the answer would come, "I'll try it." Why? It must be in the air. In regard to iron, the best Dannemora still maintains its pre-eminence for some special purposes, but the great bulk of American steel is now made of American iron, only slightly, if at all, inferior to the Dannemora, and costing less than one-third as much. In the sixties, axe steel and fine edge tool steel cost about 16 cents a pound; in the nineties, axe steel sold for 4 cents a pound, and the axe makers say the steel is good, and that they are inspecting and testing their tools more rigorously than ever before.

It is proper to say that the concern referred to is now prominent, suc-

cessful and wealthy. Whether the difference in the skill, energy or efficiency of the mechanics of the two countries is a determining factor in competition, it is impossible for one to say who has no other knowledge of these characteristics of the men in one nation, than such as any man may obtain who reads such papers as *Engineering*.

Thirty years of experience with him in this country leads one to the conclusion that John Bull is a thoroughly good fellow—strong, active and ambitious, and obliging when he is taken in the right way. He is generally prosperous and well-to-do, and owns his own home or builds up a business for himself when he uses his ale sparingly. Ale and the climate of America do not appear to agree, and when the disagreement is reinforced by hard liquor disaster follows.

As to engineering ability, skill, scientific knowledge and patient and careful research, English engineers are certainly in the front rank in skill and knowledge, and well in the lead in careful and patient research. If we Yankees are in too much of a hurry to give time to patient research, we take time to read your technical jurnals, and sometimes we profit by them. In regard to Nature's gifts, we are all familiar with the exceptional bounty to England, but it seems as if the world had hardly begun to realize the remarkable richness of the great Appalachian region of the United States.

From well up in New York, extending in a southwesterly direction through Pennsylvania, the Virginias, North Carolina, Kentucky, Tennessee and far into Georgia and Alabama, is a mountain region abounding in coal, iron and other minerals. There is scarcely an arid acre in the whole region, and the climate is healthful and invigorating. This country is flanked on all sides by some of the richest agricultural districts in the world. It is traversed by numerous large rivers, the navigable distances from Pittsburg being given at about 15,000 miles. Coal is as the dirt in the hills; it is estimated that in Western Pennsylvania alone, above the water levels, and leaving out all veins less than 3 feet thick, there has been enough good coal located by the State Geological Survey to supply all of the demands of this continent for 500 years. Add to this the great known deposits below the water levels, the States of West Virginia, Maryland, Kentucky, Tennessee and large parts of Alabama and Georgia, and you have a coal area where you might hide the whole British coal district several times over.

If there is another spot on earth of such size and great natural wealth as this Appalachian region, man has not discovered it, or if he has, he has not made it known. This, then, is enough in considering the probabilities of the future; your readers are already well informed as to how much more there is in our country. You know of our annual output of millions upon millions of tons of coal, iron, steel, glass, etc., and yet the greater part of our Appalachians is virgin territory, where you may hunt the wild turkey and deer in immense forests of fine timber, where the speckled trout abounds in the streams, and where the natives still find corn pone and hog and hominy sufficient for their wants—a diet not to be despised after a day's tramp in the woods.

In the near future the competition between us will be keen, sharp and vigorous; let us conduct it as fairly and in as manly a way as our cup challengers and defenders have done recently. In the far future, when you have practically exhausted Nature's bounties, there will be room over here for all of your workers, and over there a lovely resting place for the worn and weary. In the meantime, as between ourselves, "Let us have peace."

The Return to Gas in the Street Lighting of a Municipality.

By Mr. E. H. Yorke, of Portland, Me.

It is an interesting commentary on the evolution that time and the development which improved methods bring, when a municipality, after substituting the electric light for gas street lighting, continues it for 15 years and then returns to gas lighting. Such a result would have been among the impossibilities, but for the invention of the Welsbach light.

When, some 15 years ago, an electric light company installed a plant in this city, and offered to this municipality a lighting method which had the novelty of newness and the claim of instantly lighting space remote, with but the moving of a lever at the central station, the minds of the people were charmed with the simplicity of the method and the wonderfulness of the result. Adding to this that, by the simple stretching of wires, points far beyond the limits of gas mains could be instantly illumined, the result was that the street lamp was at once regarded as a relic of the dark ages, and both the electric arc and incandescent lights were viewed as the realization of the high achievements of modern invention and discovery which were to displace the old and crude methods for all time.

Such, then, was the view held 15 years ago of this agent the electric light; and without hesitancy, and with the fullest confidence that a better method had been discovered, the gas street lights were relegated to oblivion, their places being taken by this new lighting agent. But time, that leveler of all things to their real and true worth, finally brought about a true measurement of the value of electric street lighting, which was found in the end to possess many disadvantages that were decidedly objectionable.

A summary of some of these disadvantages included the following: First, the stringing of unsightly wires through the public thoroughfares; second, the serious disadvantages of these wires when fires occurred; third, that such exposed wires were subject to disturbance by ice storms; fourth, any break in a circuit extinguished all the lights in that circuit; fifth, that the arc lights were disposed to get out of proper adjustment, giving but a feeble light for frequent and extended periods; sixth, that their high candle power was not without its disadvantages, because of the intense light in a comparatively small zone and its inability to penetrate beyond the shade trees, thereby not lighting the portions of the streets so shaded.

For all these reasons it was obvious that the arc light, notwithstanding its high candle power, did not meet the requirements of efficient street lighting. The drivers of vehicles, trolley car motormen and the patrolmen were strongest in its denunciation.

Experience has established, due to the enormous waste of light, that arc street lights must be placed at not less than 300 feet apart to effectually light the streets of a city. This means 17 arc lights per mile of street, which at $90 per arc (an average fair price) makes the cost of street lighting by this method $1,530 per mile.

This sum was obviously too expensive for the average city street lighting, hence the practice has been to maintain the lights as a rule at more than double the named distance apart, with the result that, in the residential streets upon which shade trees are numerous, a condition of semi darkness has prevailed.

Regarding incandescent electric lights but little can be said in their favor for street illumination, judging from the average results. In this city 16-candle power lights were first used. These, proving unsatisfactory, 32 candle power lights were substituted, which, in turn, were displaced with 65 candle power lights. But the inherent faults of this light—the constantly diminishing candle power and the blackening of the bulb—have made it far from a satisfactory street light. The result has been a constant displacement of them with arc lights, and, in the heavily shaded streets, with a lower hanging of the lamps in the futile attempt to throw the beams of light beneath the foliage of the trees.

The status, then, of the street lighting question at the time of the appearance of the Welsbach street light was far from satisfactory. The unsightly poles and dangerous wires, the excess of light in a small zone immediately surrounding the arc ight, with its blinding effect and intense shadows, the dark and unlighted portions of the streets between the arc lights, notwithstanding the excessive cost for street lighting, plainly suggested the desirability of a light which admitted of being divided, thereby giving a better distribution of illumination.

For all these reasons the Welsbach street light was warmly welcomed. It did not require the average citizen long to discover that this new light would illuminate the streets far better than did the arc or the incandescent electric light, and at no greater cost, that it was a steady and reliable light, was unaffected by storms (if one light failed the others continued to burn), was ornamental in appearance and lighted effectually a distance of 200 feet. With the posts this distance apart, the streets were most effectively lighted.

It has thus come to pass that the electric light, which on its advent was heralded as the light of the future, has been tried and found wanting, and incandescent gas lighting has been found to be more effective, more desirable and more reliable than either the arc or incandescent electric light when employed for municipal street lighting.

Cities and Public Works—The Correct Story of Glasgow's Achievements.

By Mr. Robert Watt, of Oakland, Cal.

Among current topics discussed by the press and on the platform is the question of municipal ownership of public utilities. The advocates of this form of socialism refer us to the municipalities of Great Britain for examples of success in that line, and the city of Glasgow is often

quoted as the most conspicuous example of the success of the system. Comparisons are made between the rates prevailing there and in California, and the difference is credited to municipal ownership; the most extravagant statements have been made as to the profits realized by the city from the operation of its public utilities; it has even been said that the profits pay all expenses of the city government. There is no truth whatever in this statement, and I propose to utilize the few minutes allotted to me in stating a few facts regarding the water and gas supply of Glasgow and the rate of taxation in that city.

Glasgow, by and through its Council of 78 members, has managed its public utilities so well as to make them pay their own way, the interest on money borrowed for their purchase and extension and to add something yearly to the sinking fund; but this has been done under circumstances so favorable as to make any comparison between rates there and in our State unfair.

The natural conditions are such as to give Glasgow the cheapest water and gas supply, probably, in the world. In California the natural conditions make these commodities the dearest.

Since the year 1859 Glasgow has received its water supply mainly from Loch Katrine, a beautiful natural lake distant 34 miles from the city, having an elevation of 360 feet above tide at Glasgow, a surface area of 3,000 areas and a drainage area of about 25,000 acres. The annual rainfall is from 80 to 90 inches; the rain falls throughout the year; the sunny days are few in number and the evaporation light; so the requisite storage capacity is insignificant when compared to the immense volume of water supplied daily.

The works were originally designed to supply 50,000,000 gallons per day, but as the city was growing rapidly it soon became apparent that a much larger supply would be wanted in the near future, and in 1885 authority was obtained from Parliament to construct a new aqueduct and to raise the level of Loch Katrine 5 feet.

The fact that the raising of the masonry dam across the narrow outlet of the Loch only 5 feet more than doubles the capacity illustrates clearly the very favorable conditions which prevail.

When the new works are completed, which will be shortly, they will have a capacity to supply 110,000,000 gallons of water per day, an increase of 60,000,000 gallons, and the supply of this vast quantity daily is possible with a storage capacity of less than 10,000 million gallons, because the water is stored in the clouds, which never fail them.

The Spring Valley Water Company's storage reservoirs for the supply of San Francisco have a capacity of 30,000 million gallons to provide a daily supply of 25,000,000. Glasgow requires a storage capacity of only 90 gallons for every gallon supplied daily. The Spring Valley Water Company, because of our peculiar climatic conditions, requires a storage capacity of 1,200 gallons for every gallon supplied daily.

Glasgow charges to its consumers outside of the city, for domestic purposes, a rate of 10d. per £1 rental value of the premises supplied. In the city, or, as the reports state it, within the limits of compulsory supply, the charges are for domestic purposes a public rate of 1d. per £1 to be paid by the owner, and 6d. per £1 on the rental value to the occupant, a total of 7d. per £1, or 2.92 per cent. of the annual rent of the property.

If the same rates were charged in Oakland, and on a like basis, my landlord would pay $4 and I would pay $24, a total of $28 per annum. I actually pay $52.80 per annum, but the Contra Costa Water Company supplies me under conditions which make it vastly more expensive to them, and I am sure I use double the quantity of water that a Glasgow man similarly situated would use. Why? Because the climate of the west of Scotland is a very wet one, the average rainfall being near to 60 inches and well distributed throughout the year. The umbrella is in almost daily use, the garden hose very rarely, and the sprinkling cart never.

In 1898 the consumption of water for domestic purposes in Glasgow was 34 gallons per day per head of population. In San Francisco it was more than 70 gallons. I have no figures for Oakland, but believe the consumption per head greater than in San Francisco, and the evaporation at the lake greater, requiring a larger storage capacity.

The original cost of the Glasgow water works, including city piping, was £2,500,000, and the estimated cost of the new works is £1,500,000—say a total of 20 million dollars. Up to May 31, 1897, the amount expended was £3,668,340, of which £525,380 is in stock annuities, paying 4½ and 6 per cent.

I know of no other city so favorably situated to obtain a bountiful and cheap supply of pure water as is the city of Glasgow, and for the production of cheap gas its position is equally advantageous. In the very heart of the coal fields, it obtains its gas coal at $2.23 per ton of 2,240 pounds, including carriage, and the manufacture of chemicals being a leading industry in the city, the residual products of the gas works find ready sale.

It was in 1869 that Glasgow decided to go into the lighting business; the city was then supplied by two private companies, having a combined share capital of £415,000, and mortgage debts amounting to £119,265. The city, however, did not confiscate the works or seek to destroy the capital invested therein by constructing new works in opposition; as in the case of the water works it took up the shares of the existing companies, of which there were two classes, as is common in British joint stock companies, and converted these shares into perpetual annuities on which it pays interest at 9 per cent. per annum on £300,000 and 6¼ per cent. on £115,000. It also took up the mortgages and continued to borrow as required for the extension of the works, its borrowings on May 31, 1892, amounting to £988,435, on which the interest is at 3½ per cent., and $3\frac{1}{16}$ per cent. per annum, the total capital then invested being £1,403,435—say about $7,000,000.

During the 28 years of operation by the city, up to May 31, 1897, the growth of the business must have been enormous, for though the price of gas has been reduced fully 50 per cent. the gross revenue has increased 157 per cent., amounting to £607,622, the last year of the period. The quantity of gas sold during the same year was 4,625,781,000 cubic feet, about 4½ times greater than the sales of all the gas companies of San Francisco combined. This enormous output of gas is a large factor in cheapening its production; but, in addition, every item of expense is much lower than in San Francisco. Labor costs less than half, coal about one-third, being $2.23 per ton against $7, and Glasgow has a demand for its by-products that yields over $538,000 per year. In the earlier years of the city's operations, when the price was about double it is now, the reports show a deficit in three different years. Doubtless improved processes, lower cost of coal and other materials have contributed to lessening the cost of manufacture, and the city being compactly built, the cost of distribution is also light, but as before intimated, the great and increasing volume of business is probably the main factor in making cheap gas possible.

The price of gas is 2s. 2d., equal to about 53 cents per 1,000 cubic feet. Glasgow makes no charge for rent of meters, unlike Edinburgh and some other cities, but requires a deposit in security of its gas bills, the deposits aggregating £25,960.

The sinking fund receives annual additions and with its accumulations now amounts to £331,023, but neither the water nor the lighting department contributes in any way towards the expenses of any other department of the city government. Each stands by itself; bought originally by the issue of annuities, extensions made wholly from the proceeds of borrowed money, they have been made to pay their way without in any manner affecting general taxation.

All taxes are levied on an income basis, that is, in proportion to the annual rental value, whether it be for municipal purposes, or through the Inland Revenue Department for purposes of the general government, and the rates assessed to the occupiers of property, which seem large at first sight, are in lieu of taxes on personal property.

The rates are uniform for £10 rentals and upwards; below £10 the rates are lower for certain purposes, and for occupancies worth £4 or less, the taxes are paid wholly by the owners.

For the fiscal year 1898–9 Glasgow levied on £10 rentals and upwards, for general municipal purposes and for the support of the schools and the poor, to be paid by occupiers, 3s. 3d. $\frac{13}{16}$ per £1 rental, equal to 16¼ per cent, to be paid by the owners 1s. 7d. $\frac{7}{16}$ per pound rental, equal to 8¼ per cent. The owner occupying his own premises pays both taxes, equal to 25 per cent. of the annual rental value.

In addition to this the general government collects through the Inland Revenue Department a small tax on land, also "inhabited house duties," together amounting to about 4 per cent. of the rental value, and every person having an income of £300 per annum or over, whether derived from trade, profession or the ownership of property, home or abroad, pays a tax of 8d. per pound, equal to 3½ per cent. of his income.

It will thus be seen that Glasgow is very far from being free from taxation, and this, one of the stock arguments of the advocates of municipal ownership, has no foundation in fact. Doubtless it is a well-governed city, and, especially in the matter of the sanitary improvement of the city, the Council has worked wonders, but it should not be forgotten that Glasgow and the other municipalities of Great Britain are under different conditions and a totally different system of municipal government, a civil service system well established and so acceptable to their people that there is no fear of interference with it either by executive or legislative authority.

Municipal ownership under our political system means a change in the management every two or four years, the appointment of em-

ployees with reference to and as a reward for activity in ward politics, the highest compensation for the shortest hours of service, a refuge for decayed politicians of the lowest class, and, in the case of manufacturing industries, a lagging behind the times in methods and processes of manufacture.

Under private ownership the managers are trained men, having expert knowledge of the business, and are usually themselves financially interested in its results, and the employees are selected with reference to their fitness for the work they undertake, paid in proportion to their capacities and retained so long as they give good and faithful service to the corporation. The most advanced methods and processes are adopted under expert supervision, and the whole business of the corporation is conducted with an eye single to obtaining the best results.

It is not in the nature of things that public work will be so well and economically done as by private management; the English city governments, including the oft-quoted cities of Manchester and Birmingham, recognize this fact by leasing to operating companies their street railroads at an agreed rental. Politics will creep into the management of all municipal affairs, and all experience shows that the more rigid the exclusion of politics from the management of any public institution the more successful will be its administration.

I believe it to be the duty of every community to encourage private enterprise and to protect, rather than seek to destroy, invested capital, and if there are not good economic reasons for the change, the ownership and management of the public utilities should be left to private companies.

That the business will be conducted more intelligently and with greater economy in private hands than under the spoils system of municipal management will hardly be questioned. Before we can have a successful administration of public works by the municipal authorities we must have a thorough reform of our system of municipal government. The merit system must be substituted for the spoils system, and until that is an accomplished fact a just and intelligent control of the quasi-public corporations will be better for all concerned than public ownership.

The laws of California confer on the governing bodies of cities and counties the power to regulate the quality and price of the public supply of gas and water, and there would seem to be small excuse for destroying invested capital in these enterprises and little reason for the advocacy of municipal ownership. If our city officials cannot be trusted with the regulation of the price and quality of the public supply, they surely cannot be entrusted with the operation and management of great industries, offering tenfold greater opportunities for corrupt practices; there is no special virtue about a gas or water attachment to a municipality to make its officials more honest or more devoted to duty, and you do not reform a dishonest man by giving him larger opportunities for wrong doing.

Before conferring further powers and responsibilities on our city officials, wait till they have given evidence of their ability to manage well what they have.

It will be time to discuss the question of municipal ownership when they have given us a good sewer system at reasonable cost; streets well paved and clean, with clean management; a good park system, and the school department conducted without scandal; when we can say to our officials: You have been faithful over a few things, we will make you rulers over many.

Rope Haulage in Mines.

Engineering and Mining Journal says that by far the greater number of the mines in this country, particularly in the smaller precious metal mines of the West, the labor of tramming or pushing the pre-cars to the shaft from the breast, where the ore is mined, or from a shute from an upper level, is still done by laborers. In coal mines, however, or other workings, where as the mineral excavated is but a few feet thick, it is necessary to have a large amount of ground open to get a heavy output, and where large amounts of mineral must be left as pillars to support the rock overhead, the working faces soon are so far from the shaft that hand tramming is prohibited by the cost. For short hauls, the mule in this country and the pony in England are largely used. As in opening the mine it becomes necessary to bring larger amounts of mineral to the shaft than can be done conveniently or cheaply by horse power, mechanical appliances are demanded. The chief mechanical appliance that is in use for bringing coal or other materials to the shaft along the main gangways of the mine is some system of wire rope haulage.

The use of underground locomotives is constantly increasing. Steam locomotives are prohibited in many mines, on account of the danger of fire. They also foul the air. Electric and compressed air locomotives are continually coming into wider use. The advantage of rope haulage over electric locomotives is that there is no danger from sparks in the case of fiery mines, nor from shocks to miners from the naked wire, which may lead to loss of life. Electric locomotives also require the installation of a dynamo with a consequent loss of power between the coal burned under the boiler and the force applied to the car. They also call for a high grade of labor, heavier track, and care all around. A compressed air locomotive is free from the first two objections just stated, but it needs the installation of a compressor and a possible loss by friction and leakage in the pipes. It also needs skilled labor, heavy track and a heavier initial expenditure for putting in a plant than an electric railway, but it has the advantage of greater flexibility as it carries its motive power about with it.

In laying out any system of haulage the most important factor and the one that needs to be most accurately established is which system is most capable of distributing the necessary power over the area to be worked, also which will involve the least manual labor and can be best handled with unskilled help. The haulage rope has the advantages that it can be applied to the distribution of the steam power direct from the engine on the surface. All rope haulage systems are divided into two classes, each having certain advantages for certain work and certain locations. These two systems are the endless rope and the main and tail.

The former is the system generally used for surface work about mines or mills, and is the system employed in the cable roads of our large cities. In this system a rope of uniform size, proportioned to the load it will have to move, is driven by passing once or twice round a pulley which is usually actuated by a steam engine, either directly or by gearing; at the end of the haulage line the rope runs over a large sheave or a series of small sheaves. This arrangement generally necessitates a gangway wide enough for two tracks, or two gangways near together with a track in each. On one track the loaded cars that have been brought in by mules from the branch tracks to the main line are hauled to the shaft, and on the other track the empty cars are hauled back. The action of such a system being continuous, a large amount of coal can be brought to the shaft with a rope traveling at a low rate of speed, not over 4 or 5 miles an hour. In consequence of this, the jolting of the cars is reduced to a minimum, the wear and tear of rails is small and the rolling stock is not abused. Pieces of rock are not likely to fall from the loaded cars, thus derailing other cars, and there is little danger of cars jumping the track on rounding curves. The rope may travel above or below the cars; but the best results are obtained when the cars are attached singly to the rope, catching automatically by a clip on top of the car. If the cars are topped much the rope will have to travel underneath them. In a form of endless rope haulage, known as the series system, an endless rope transmits power from an engine on the surface, down the shaft to a pulley on a shaft in some convenient place underground to which other pulleys may be geared with clutches, and from these pulleys other ropes are worked over the various gangways. To these ropes the cars are attached, and from the return pulley at the terminus of each gangway a third endless rope may be driven to haul over a secondary branch. The one great objection to this general scheme is that if anything goes wrong with the main rope the whole plant stops.

As the cars on the empty side in an endless rope system balance those on the loaded side, the load on the engine will be the weight of the mineral, multiplied by the average gradient, plus friction. It is of the greatest importance, therefore, that the car should be attached in a uniform and systematic manner to even the load upon the engine. The advantages of the endless rope lie in these two particulars: the cars can be attached singly, distributing the load uniformly, and the attachment can be automatic, thus giving a minimum of power and a minimum of manual labor. One great objection to the use of the endless rope system below ground is the necessity in most cases of using two roadways, which are difficult to keep in good condition where the ground is bad. There are instances, however, where this system is used with but one rope underground. For instance, at one of the mines of the Susquehanna Coal Company, at Nanticoke, Pa., and at other Pennsylvania collieries, the rope runs over rollers on the surface for perhaps a mile to a point over the foot of the main haulage plane, and thence down a bore-hole to the big sheave at the bottom. The empties in such cases may run back to the foot of the plane by gravity.

In spite of its many good points, the endless rope system is probably in less use than its rival, the main and tail. This system is used in mines where the ground is such that only a single gangway can be

easily kept open, and where the grades are not too heavy, not over 3 per cent. The system is worked by an engine on the surface or underground. There are two drums, fixed generally on the same shaft, which are thrown in or out of gear by clutches. It necessitates the use of two ropes, a main and a tail; the main being the length of the gangway, and the tail rope usually double that length. By branch ropes it is possible to haul over several gangways. In this case, as any delay in one gangway involves a corresponding delay to the others, it is important that the branch ropes should be capable of being connected or disconnected quickly.

The cars, instead of being connected singly to the rope, as in the endless rope system, are usually made up into trips, and the rope travels at a high rate of speed, frequently 10 miles an hour. This rapid speed necessitates heavier rails, and there is more wear and tear on the cars. The system is much used in Pennsylvania, and a model plant of this type is installed in a mine at Providence, near Scranton, in that State. The loaded cars are hauled at a speed of over 15 miles an hour. While the main rope may be stronger than the tail rope in the ratio of 3 to 2, yet as both ropes must be kept in equal tension by the use of the brake it is often well to have them the same breaking strain. A careless engineer may have the brake firmly set on his tail rope drum when the engine is pulling with full strength on the main rope. Many breakdowns are due to this. In laying out the track, on account of the high rate of speed, the curves must be proportioned carefully, and particular attention paid to the rollers or sheaves. On one short curve, one large sheave is better than several small rollers, as one bearing needs less attention, and is less liable to get out of order than several. In putting in several sheaves they should be so close together that the ropes should travel round the curve without making angles at each sheave. It is also very important that the large sheave at the end of the plane should be as large as possible, and the tread of the pulley not wider than the diameter of the rope, thus distributing the abrasion of the rope over as large an area as possible. This pulley may be horizontal, vertical or at an angle, as circumstances permit, or conditions compel. In both endless and tail rope systems, the rollers supporting the rope will last longer if put alternately more to one side of the center line of the track than the other. Then, when one end of the roller is worn, it can be turned over, and the life of the roller is greatly increased.

The different factors entering into any system of haulage are labor, maintenance, cost of motor power, and cost of installation. The total cost by rope haulage in England was estimated at 4 cents per ton mile some years ago. In this country lower figures are usually obtained, and estimates as low as 3 cents per ton mile, or even less, have been made.

Lubricating Oils.

A contempory says that the use of oil as a lubricant in machines of all kinds and descriptions, is to separate the rubbing parts and to diminish the friction of metal upon metal by an intervening film of the lubricant. There are not to exceed two cities in the Union (perhaps only one) that do a larger business in the manufacture and sale of lubricants and lubricating oils than Chicago. For a long time past invention has sought various methods for diminishing the use of lubrication and diminishing the cost of machine construction by doing away with many devices incident to oil, oil cups, oil hole covers, the oil holes themselves which have to be drilled and carefully placed, oil tubes to lead the lubricant required to inaccessible parts of machinery, as well as the expense of personal attention, and the cost of the lubricant required to keep the machinery in working order, but all these efforts, for the greater part at least, have resulted in failure. Machinists in all parts of the world still cling tenaciously to the oil can, from the man who oils the ponderous machinery in the great water works plants of our cities, the engineer who drives the powerful locomotives across the country, down to the hand that oils the sewing machine in the household, or he who deftly oils the delicate machinery used in making the finest parts of watches. For machinery purposes, great or small, oil is still the great lubricant most extensively in use, and therefore the one most largely sold, holding its place in the push of some other lubricants which are pressing their claims upon the general markets for supremacy.

It can hardly be said that all oils put upon the market as good lubricants are in fact so; on the other hand many oils have been sold as lubricants which have been found, upon use, to possess very little value, but lubricating oils of this character soon find their proper level. According to Spon, an efficient lubricator must exhibit the following characteristics: (1) "Sufficient 'body' to keep the surfaces between which it is interposed from coming into contact; (2) the greatest fluidity; (3) a minimum co-efficient of friction; (4) a maximum capacity for receiving and distributing heat; (5) freedom from tendency to 'gum' or oxidize; (6) absence of acid injurious to the materials in contact with it; (7) special adaptation to the condition of use; (8) freedom from all foreign matters." The foregoing may therefore be considered as the prime essentials in a good lubricating oil. The well-known property of graphite, as a lubricant, has encouraged many attempts to so combine it with other materials, that it might be used as a complete substitute for metal bearings, but up to the present time, with possibly one or two exceptions, no one of these has succeeded to the extent of securing but a limited adoption.

A good many thoroughly practical oil men, as well as dealers in oil, have made the study of lubricating oils a long, patient and persevering one. Their object has been to introduce an oil which will reduce the frictional resistance to a minimum, either by presenting as rubbing surfaces materials which slide easily one upon the other, or render motion safe by means of lubricants. We understand that the best oils, while diminishing frictional resistance, do not, under ordinary conditions, prevent the wear of metals rubbing one on the other, as is well known to all engineers. The study, therefore, of lubricating oils is a very important one, for it is, in many cases, a question of how much we can afford to pay for power lost through the use of lubricants that prevent the wear of rubbing parts, or how much wear can be permitted with loss in the power required to drive machinery. The great defect of lubricating oils in general is that they gum and become acid. This is especially true of fatty oils, both animal and vegetable, for in spite of very careful preparation they are liable to oxidization by the air, the result being the production of a gummy matter possessing more or less acidity.

The difficulty of getting an oil for lubricating purposes that will give entire satisfaction is still to be met with, and the study of oil for this purpose is still a foremost one. The day when sperm oil was used so extensively as a lubricator has long since gone by, in part, but not wholly, on account of its scarcity and high price. None of the oils now in use for lubricating purposes have a lubricating power equal to sperm oil in its entire purity and freedom from adulterations. It must be borne in mind that even in this advanced age in chemistry, there are no decided and definite tests for each kind of oil, as there are for each kind of mineral substance, and that, in arriving at a conclusion as to the composition of any oil or mixture of oils, the analyst can only be guided by what may not inaptly be described in our criminal courts as "circumstantial evidence," several tests indicating a balance of probabilities in one direction.

As a market for the sale of lubricating oils, as already stated, Chicago occupies not only the leading position, but as a manufacturing point of lubricating oils, involving as they do, large and small, nearly $2,000,000 invested in the business. There is a vast manufacturing district in and around Chicago where the busy hum of a vast line of machinery is in operation night and day. Chicago is, in fact, the center of a great manufacturing district which reaches out and extends to all the suburban places within its environment. These vast machine districts have to be supplied with thousands upon thousands of gallons annually of lubricating oils to keep this vast power of machinery in motion, and the consumption of machine oils is therefore very large. It is a constant study with some men how to produce an absolutely perfect lubricating oil, as there is at the present time no such article on the market. The uses to which such an oil, or a material of a lubricating kind, may be put, in a range of mechanical uses, covers so wide a field that it is a laudable ambition that seeks to discover some new material or substance out of which it can be produced. The mechanical world is waiting for a better and more compensating lubricant than it now possesses, without saying that some of the lubricants now on the market do not to the extent of their merits give a reasonable measure of satisfaction.

Progress of the Paris Exposition of 1900.

The *Scientific American* says it was a foregone conclusion at the close of the Exposition of 1889 that another great gathering beside the banks of the Seine would be held by the end of the century, and in a few months the Exposition of 1900 will have thrown open its doors, and for the eleventh time France will welcome the world to her exhibition. The Exposition of the year VI. was held on the Champ de Mars under the Direceory in 1798; the Exposition of the year IX. (1801) was held in the Court of the Louvre; the Exposition of 1806 on

the Esplanade des Invalides; the fourth was held in 1834 on the Place de la Concorde; the Exposition of 1844 on the Champs Elysèes; the next Exposition was opened in 1849, also on the Champs Elysèes; the Exposition of 1855 was held in the Palais de l'Industrie on the Champs Elysées, which has just been taken away to make room for the Grand Palais of the Exposition of 1900. The Exposition of 1867 was held on the Champ de Mars, as was also that of 1878 and of 1889.

Paris is unfortunately situated for the purpose of giving expositions on a large scale owing to the fact that about the only available spaces which it has are the Champs de Mars, the Esplanade des Invalides, and the park between the Trocadéro and the Seine, and the triangular bit between the Champs Elysées and the Avenue d'Antin. There is one advantage, however, for this valuable territory lies in the center of the city and is accessible from almost any point. For convenience it can be said that the Exposition of 1900 is made up of six sections. First, the Champs Elysées, which is connected with the second section on the Esplanade des Invalides by the Pont Alexandre III. The third and fourth sections lie on both banks of the Seine and make an unbroken line of buildings on both sides connecting with the fifth and sixth sections on the Champs de Mars and at the Trocadéro.

The Exposition of 1889, properly speaking, did not have any main entrance, but this has been remedied in the present instance by building an enormous construction on the Place de la Concorde end of the Quai de la Conference. This triple archway will have a span of 59 feet and is 65 feet high. The sides have penetrations consisting of smaller arches. At both sides will be a large number of gates, arranged in a fan shape, which will permit of 60,000 persons per hour to pass through them. The entrance is built of light masonry and is covered with enameled sheet iron. The summit of the arch is surmounted by a gigantic statue of "Peace." Two large exedra join the great arch at the bottom, adding to its appearance of strength. Two lofty minarets flank the arch. From the illustrations which have been published of this entrance, it is doubtful if the effect will be at all good from an architectural point of view. The architect has thrown to the winds all of the canons of his art, and we will be surprised if the result is successful.

One of the engravings represents the Grand Palais of the Champs Elysées, which is not far from the monumental entrance. It occupies the site of the Palais de l'Industrie, which has been destroyed to give place to it. The architectural design was obtained after a severe competition, and M. Bouvard was selected as the architect. The result is that the building is a most handsome and pleasing one and is in marked contrast to most of the Exposition buildings, whose ephemeral character is no excuse for decorative aberrations. It will cost about $4,000,000. The building is admirably arranged for the display of art collections, and access to the various halls is easily obtained by numerous stairways. The curved ends, such as are shown in the engravings, produce an excellent effect. The building will, of course, be permanent as it is being constructed of fireproof material and the workmanship is of the very best. Another art palace devoted to retrospective French exhibits faces it. This smaller palace of art will also be permanent. The grounds about the palace of art are being beautified in such a manner that the landscape gardening which is being done will connect naturally with the existing shrubbery and trees, which will give a park-like aspect which will harmonize with the famous promenade, the Avenue Champs Elysées immediately to the north.

The splendid Avenue Nicholas II. brings the visitor to the Pont Alexandre III., which connects the second great section of the Exposition with the entrance and the art palaces. This bridge is one of the most beautiful, from an architectural point of view, which has ever been built. The corner stone of the structure was laid October, 1896, by the Czar of Russia. The bridge is 360 feet long and the width is 131 feet; the approaches are monumental. Two pylons will be placed at each end surmounted by statues, and statuary is freely used throughout the bridge, which is constructed of steel with stone approaches. This bridge will be illustrated at some future time. One of the engravings shows the present condition of the Esplanade des Invalides, looking down toward the dome of that building, which is directly over the tomb of Napoleon. These palaces will be largely dedevoted to exhibits in manufactures and the various industries and include the Palace of National Manufactures, the Palace of Miscellaneous Industries, the Palace of Ceramics and Glass. There are two sections of each building, one on either side of the esplanade, one devoted to French products and manufactures and the other to foreign exhibits in the same class. These buildings will form a continuous group.

A large number of visitors from out of town and outlying sections of the city will enter the grounds at this point from the new Gare des Invalides, the station being underground. On the Seine's north bank west of Alexandre III. bridge will be placed some of the most interesting and beautiful structures of the Exposition. On the south embankment will be constructed the Palaces of the Nations, in the midst of which our national building has a prominent position. A little further along on the southern side of the river is the building devoted to army and navy exhibits. Beyond this is the Palace of Commerce and Navigation. Then comes the Point d'Iéna, connecting the Trocadero ground with the Camp de Mars. Beyond this are the buildings devoted to forestry, hunting and fisheries. The Gare de Camp de Mars comes up directly to the buildings on the Camp de Mars and affords a third important entrance to the Exposition. The Eiffel Tower on the Camp de Mars has been left to form a salient feature of the entire group of buildings. The view from the foot of it, even at the present time, is most imposing. To the left rises a building devoted to mines and metallurgy, one section of which is shown in the engraving. Next comes the palace devoted to textile fabrics and cloth; then comes the huge palace devoted to mechanics, while directly in front is the Electricity building, whose façade is composed of an enormous Château d'Eau, while behind rises the large roof of the building which includes the agricultural exhibit, food products and a salle des fêtes. On the other side of the fountain there is another section of the Mechanical building, then comes the Palace of Chemical Industries, then the Palace of Civil Engineering and the palace devoted to education, letters, arts and sciences.

It is impossible at the present time to get an adequate idea of what the effect will be when entirely finished, as to color, etc., but we may safely trust the taste of the French to produce an ensemble which, while it may be very pure in details, will not be barbaric. In the grounds surrounding the Trocadéro will be the buildings forming the colonial exhibits. Along the north bank of the Seine will be buildings devoted to horticulture, arboriculture, the city of Paris, and a unique group of buildings representing Paris of the middle ages. This is probably the most important amusement section of the Exposition, and will be devoted to theaters, concerts, restaurants, cafés, etc., as well as to show the appearance of Paris in the fifteenth and eighteenth centuries. The studies for this most attractive and monumental group of buildings were made by M. Robida, well known as a draughtsman of the architecture and life of the middle ages. There are 42 distinct sections in the group of buildings, each one representing a different phase of the life and activities of old Paris.

There is another section of the Exposition at Vincennes for agricultural machines, carriages, bicycles, automobiles, etc., and direct connection can be had from the Exposition proper by means of steamboats and trolley cars. The space to be occupied by the Exposition proper is 360 acres, and of this amount the French government has given about 60 per cent. to other nations and reserved about 40 per cent. for France. The Exposition will open on April 15, 1900, and there is every indication at present that it will be ready at that time.

The Elasticity of Portland Cement.[1]

The results of a series of experiments to determine the elasticity of Portland cement were transmitted about two years ago to a students' meeting of the Institution of Civil Engineers by Mr. W. L. Brown. The advisability of such an investigation had been previously pointed out by Sir Benjamin Baker. The experiments were made by Mr. Brown at the University College, Liverpool, while a student under Prof. H. S. Hele-Shaw, M. Inst. C.E. Their object was to determine the coefficient of direct elasticity of cement and cement mortars and its variation with different kinds of sand, with different proportions of sand and with age. The experiments were made with neat cement and with mortars made with 1 part of cement to 1, 2 and 3 parts of sand. Three kinds of sand were also used: A, a good, ordinary, coarse red sand such as usually used for building purposes, which was well washed before using. B, a poor argillaceous fine sand unwashed and not good enough for ordinary building purposes. C, a very coarse sand used for making concrete lintels, etc. The experiments were divided into two distinct sets, throughout each of which one kind of cement was used. The second set was made to supplement the first, special attention being paid to the points where the first set was incomplete.

The tests were made with 1 by 2 inch beams having a length of 36 inches, except in a few cases. In making these beams the cement and sand were first measured in the proportions required and put in a mixer. After they had been well mixed dry, water was gradually added and

1. *Engineering Record.*

Summary of Results of the Tests.

	Neat.	Sand A.			Sand B.			Sand C.		
"B."—I.		1:1	2:1	3:1	1:1	2:1	3:1	1:1	2:1	3:1
1 week	1,850,000	1,450,000	1,010,000	....	790,000	....	....	1,060,000	....	....
1 month	2,050,000	1,860,000	1,620,000	1,310,000	1,630,000	1,000,000	....	1,590,000	....	....
3 months	2,530,000	2,060,000	2,050,000	1,570,000	2,000,000	1 640,000	....	2,410,000	....	....
6 months	2,800,000	2,980,000	2,210,000	1,710,000	2,680,000	2,100,000	....	2,720,000	....	....
"B."—II.										
1 month	1,910,000	1,390,000	1,070,000	910,000	1,050,000	....	....	880,000	....	....
2 months	2,070,000	1,810,000	1,610,000	960,000	1,610,000	1,060,000	690,000	2,120,000	1,090,000	720,000
3 months	2,280,000	1,960,000	1,520,000	1,180,000	1,830,000	1,270,000	920,000	2,140,000	1,120,000	690,000
Coef. of Elas.—I.										
1 week	2,670,000	1,870,000	1,370,000	1,610,000	1,220,000	....	....	1,680,000	....	....
1 month	2,980,000	2,590,000	2,080,000	....	2,110,000	1,510,000	....	2,720,000	....	....
3 months	3,430,000	3,150,000	2 610,000	....	2,570,000	2,180,000	....	2,860,000	....	....
6 months	3,680,000	3,350,000	2,770,000	2,110,000	2,830,000	2,490,000	....	2,980,000	....	....
Coef. of Elas.—II.										
1 month	2,060,000	2,170,000	1,550,000	1,270,000	1,610,000	....	....	1,040,000	....	....
2 months	2,580,000	2,630,000	1,990,000	1,670,000	2,070,000	1,380,000	1,000,000	2,310,000	1,390,000	720,000
3 months	2,780,000	2,550,000	1,900,000	1,340,000	2,020,000	....	1,100,000	2,500,000	1,760,000	950,000
Permanent Set.—I.										
1 week	27	20	25	....	33	....	....	53	....	....
1 month	28	26	21	22	21	35	....	34	....	....
3 months	23	34	24	20	14	24	....	16	....	....
6 months	20	17	14	....	9	15	....	17	....	....
Permanent Set.—II.										
1 month	17	35	29	20	25	....	....	21	....	....
2 months	14	27	17	25	22	27	32	18	27	19
3 months	10	18	19	23	16	....	22	15	23	22

the mixing continued until the mixture became a homogeneous mass, sufficiently damp to be worked, but still comparatively dry. A portion of this was then placed in a mould and thoroughly tamped, more was constantly added and tamped, care being taken that layers were not formed, until the mould was filled, when it was finished off with a trowel and numbered. The moulds were made of yellow pine, two pieces, 1 inch thick, of the requisite shape, being doweled together and fastened to a flat board. When a beam had set, one side of the mould was removed and the beam was carefully taken out and kept immersed in water except when used for experiment. In order to facilitate the removal of the beams the moulds were always well oiled before using, which also helped to preserve the timber and keep it from cracking. In most cases the beams were removed without much difficulty, but in the first set of experiments, of the beams made in the proportions of 1 part cement and 3 parts sand, a sufficient number to give a reliable average result was left unbroken of only those made with the best quality of sand. It was chiefly for this reason that the second set of experiments was made in which the beams made in the proportions of 1 to 3 were made 24 inches long instead of 36, and they were left in the moulds a week instead of one or two days.

The coefficient of direct elasticity was found by measuring the deflections of the beams caused by a known load at the center. The distance between the points of support was 30 inches for the longer and 20 inches for the shorter beams. Each beam was carefully gauged after it had set and its average cross section was taken. The deflections to be measured were small and the difficulty in measuring them was considerable, but it was finally decided to measure them with Professor Ewing's form of extensometer. The beams were supported at two points by brackets resting on an ordinary lathe bed. The surfaces of the supports were not flat but were portions of large cylinders so arranged that the surfaces of contact were parallel straight lines at right angles to the length of the beam. Above this beam and on the same brackets was fixed an idle iron beam, into which a vertical rod was screwed at the center, and from this the upper part of the extensometer was hung. The lower clip was fastened to a sling which hung at the center of the specimen beam and carried the rod on which the weights forming the load were suspended. When the load was applied and the beam deflected, the upper clip carrying the microscope remained stationary, while the center of the beam, together with the sling and lower clip, moved downwards. This caused the lower clip to turn about its center, one end remaining stationary while the other, which was heavier, carried the cross wire in front of the microscope, where the deflection was measured. With this arrangement the upper part of the extensometer could be left in position while any number of beams were placed in position, tested and removed. The lower part could always be left fastened to the sling, and the iron rod on which the weights forming the load were hung could be placed in position and removed after the beam had been fixed.

It was found from preliminary experiments that if the load was left on for some time there was a slight settling; most of this took place in the first half minute and after another half minute the beam had practically ceased to settle. It was therefore necessary to adopt a uniform method in order to correctly compare either the separate readings of one experiment or the different experiments. An interval of one minute was therefore allowed to elapse between the readings. An effort was made to counterbalance the initial load, but without success. In the case of very weak beams, however, the initial load was reduced by removing the rod on which the weights were hung, and substituting a light piece of cord strong enough for the load required for these beams. The beam was placed in position by sliding it over one support through the sling and on to the other support; the rod which carried the weights was then hooked to the bottom of the sling. The extensometer was then adjusted, its constant taken, and the test was begun. A weight of 1 pound was placed on the rod which hung from the center of the beam and after half a minute a reading was taken; after another half minute another pound was added, and so on, a reading being taken ever minute.

It was found that as the load at the center of the beam increased the deflection per pound slightly increased; when the maximum load that was found safe to apply had been reached and the unloading commenced, the recovery at first was small, but it gradually increased throughout the whole unloading. After the beam was unloaded it did not completely recover itself but took a permanent set, the amount of which was very irregular, but generally the older the beam the less the permanent set. During the unloading, when one pound was taken off, the beam suddenly recovered itself a certain amount and continued to recover for a short time; this effect was more protracted, especially for the earlier readings, than the similar effect which took place during the loading, yet the time between each change of load was the same, consequently the first few readings were considered to give hardly a fair measure of the elasticity.

In all of these experiments the cross sections of the beam varied and consequently, the deflections did not give the relative values of the elasticities of the various beams. In order to compare the various experiments it was necessary to find some function that was independent of the section and length of the beam. The function used for other materials is Young's modulus, and although, strictly speaking, there is no such function for cement, as the elasticity varies with the loads, a similar function was taken. This function is denoted by B, and is found from the formula, $B = WL^3 \div 48ID$ where W is the increase of load from one point to the next, usually one pound; D is the increase of deflections corresponding to this small increase of load; L is the unsupported length of beam, usually 30 inches; I is the geometrical moment of inertia of the cross-section about the line at right angles to the direction of the applied force through the centre of gravity of the cross-section; and B is the average value of the coefficient of direct elasticity for a variation of load of one pound at that point of loading.

In considering the results of the experiments curves were plotted in which the average values of B at different points during the loading of several specimens of the same age and the same material were plotted as ordinates and the loads at the center of the 30-inch beam as abscissas. These curves show that as the load is applied the value of B decreases;

that is, as the range of stress is increased the average value of the coefficient of direct elasticity throughout that range decreases. Mr. Brown states that this at first might seem to show that the absolute value of the coefficient of direct elasticity decreases as the stress increases. He shows that while this may be so it does not necessarily follow, and shows that although the value of B may decrease as the load at the center of the beam is increased, the coefficient of direct elasticity may either increase or decrease as the stress becomes greater.

Hence though the value of B from point to point shows how the beam bends, it does not give the variation of the coefficient of direct elasticity. To obtain the practical results, he considers the loading curve as straight and takes the total load and total deflection to calculate the value of the coefficient of elasticity, which gives the average value of the coefficient of direct elasticity between the extreme limits of stress obtained in each experiment. These values are given in the first part of the accompanying table. From these results he concludes that: 1. The value for neat cement is greater than for cement mortar. 2. The larger the porportion of sand present the less is the value. 3. The quality of the sand has decided effect, but not a very considerable one. 4. The value of the elasticity increases with age to a considerable extent. The accompanying table gives the mean value of B during the loading, at different ages, for both sets of experiments; the average value of the coefficient of direct elasticity as the load is taken off; and the permanent set expressed as a percentage of the total deflection for each kind of material at various ages. The variation of the elasticity is similar during the unloading to what it is during loading, but its value is higher owing to the permanent set.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At a special meeting of the Directors in the Windsor (Ont.) Gas Company, called for the purpose of changing its executive management, sequential to the death of President Jerome Croul, Mr. Isaac C. Baxter was elected President, and Mr. W. C. Croul was elected Vice-President.

It is matter for wonder that the following bit of history was not made prior to November 21st last, but all things come in time to those who have faith, whether the ultimate tidings are in favor or against. So we have to reprint, from the Bridgeport (Conn.) *Standard*, dated November 21st, this paragraph: "At a meeting of the Directors of the Citizens' Gas Company [this concern has been doing business in Bridgeport for some time], held at the offices on Broad street this noon, the matter of defaulting the payment of interest on November 1st on the $720,000 of bonds issued by the Company at the time of its organization, came up for discussion. The report of the business of the concern since its establishment, was read by the President. The Company's inability to pay the interest is said to be due solely to the fact that the Company has not done sufficient business to earn 6 per cent. The bonds called for a payment of 3 per cent. interest semi-annually." This ingenious notice would seem to fairly prompt the remark that anyone who knew anything never thought the Company could earn 6 per cent., but all inquirers interested in the bonds are respectfully referred to the Baltimore-New York syndicate that "floated them."

At a meeting of the Directors of the Portland (Me.) Gas Light Company, held the last week in November, two important steps were taken. The first move was to declare a dividend of 4 per cent. for the past half year, and the second was to send to Mr. E. H. Yorke, Engineer of the Company, a check for $500. The check was accompanied by a letter, from Mr. E. H. Daveis, President of the Company, the salient point of which was: "It gives me great pleasure to say that I am instructed by the Directors of the Portland Gas Light Company to express to you their high appreciation of the ability and zeal you have shown in planning and superintending the reconstruction of its works."

Mr. William F. Thayer, for some time in charge of the old Westfield (Mass.) Gas Light Company, has been appointed Superintendent of the Clinton (Mass.) Gas Light Company, vice Mr. H. Spaulding, resigned.

The funeral services over the late Mr. Thomas H. McCann, who had served the Worcester (Mass.) Gas Light Company faithfully for many years, were held in St. John's church, Worcester, the morning of November 14th, Father C. M. Foley officiating. Following the requiem mass, the remains were interred in St. John's Cemetery.

A correspondent in San Francisco, writing under date of the 19th November, wants to know how we interpret this notice that appeared some days before in the columns of the Santa Monica (Cal.) *Outlook*: "The Electric Light Company has leased the large and handsome store room in the Bank Block, adjoining Lee Chambers' cyclery, and will use it in the display of gas stoves, ranges and heaters, of which it will soon receive a large shipment from the East. It proposes selling gas stoves and fixtures at the lowest Eastern prices; and, at that, on the instalment plan when desired." Our reply to the query is that, on the whole, the Santa Monica Electric Light Company is doing quite well.

The town authorities of Wakefield, Mass., have determinsd to expend the sum of $1,750 in betterments to the municipal gas plant.

The proprietors of the Winsted Gas Company, of West Winsted, Conn., have declared their intention "of erecting a storage holder next spring that will be equal to the retaining of 150,000 cubic feet of gas." Our informant naively adds: "The Company frequently has to make gas twice a day now; and then, oftentimes, the quantity left in the holder is very small." Time that holder reared its crown.

The business offices of the Brattleboro (Vt.) Gas Light Company have been located in the Crosby Block, a change that should and likely will be much appreciated by its customers. The Company's trading in the last year has shown remarkable gains over its trading for 1898.

Last week we noted that the new gasholder for the Allegheny, (Pa.) Heating Company had been satisfactorily tested, and at that time our further statement was that the holder was up to a capacity of 3,000,000 cubic feet. Our report of its capacity was understated, because of an error which comes through mistakes typographical. Make the first figure a "five," and the capacity of the holder will be properly put.

The proprietors of the Clyde Steamship Company have placed the contract for a new pier shed and dock, at Providence, R. I., with the Berlin Iron Bridge Company, of East Berlin, Conn. The dimension of the building is 40 feet in width by 600 feet in length.

Writing of contracts recently awarded to the Berlin Iron Bridge Company recalls the fact that about a fortnight ago there was shipped from East Berlin a train load, carried in 27 cars, of structural material, from its works, consigned to the United States Commission, Paris, France. The material so shipped is for the steel framework of a machine shop, to be occupied solely by the American exhibitors of iron and woodworking machinery during the universal exhibition, at Paris, France, next year. This machine shop, which is to have the dimension of 77 feet in width by 340 feet in length, will be constructed of American products manufactured in America and put together on the Exposition by American machanics. In fact, the structure, from foundation to spire, and in respect of its contents as well, will be truly and only American.

The Society of Gas Lighting, through a committee appointed for the purpose of determining among other matters what it should do respecting personal representation at the International Congress of Gas Engineers, to be held in Paris, France, next year, has said: "Considering distance from home, time and expense connected with attendance upon the meeting, it would be naturally impossible to represent the Society on this occasion. Should, however, any of our associates have the good fortune to be in Paris at that time, they should consider themselves our delegates to the Congress of gas men." We had hoped that the Society of Gas Lighting would have made a rather more fraternal response to the invitation of the French Association of Gas Managers than the one reported, but its action closely corresponds to that taken in the like instance by the American Gas Light Association last fall. However, there are other Gas Associations in America that have not yet officially replied to M. Vantier's cordial invitation. Of the ones non-replying, so far as our knowledge goes, we may name: The Guild of Gas Managers, the New England Association of Gas Engineers, the Western Gas Association, the Ohio Gas Light Association and the Pacific Coast Gas Association. We have no doubt that the Western Gas Association will send a regularly accredited delegate to the Congress; and we have just as little doubt that the New England and the Pacific Coast will also have official representation in the international conclave of those concerned in the art of gas making.

"Hayden," writing to the Journal under date of November 28th, says: "On the afternoon of November 23d, Broadway, at the intersection of Canal street, west side, was the scene of a violent explosion of gas, which resulted in the loss of one life, of serious injuries to seven persons and of slighter injuries to many others. Besides the injuries to person, considerable damage to property was done. At the point

named the Metropolitan Street Railway Company's employees had been at work for some days excavating and arranging trenches preparatory to laying certain conduits for use in connection with its electric traction system. In all such work, especially in localities like the one named, delays must be, because of the real or apparent difficulties to be overcome. If the latter exist they call for experience and judgment on the part of those in charge of the work to smooth the way. In the particular instance in hand neither experience nor judgment seems to have been supplied. The spectacle of a foreman ordering his men to remove by force a live gas main, and, in order the more effectively to accomplish such removal, to instruct his men (or event to permit them) to use a lighted lantern while the 'forcing' was going on, is, to say the least, most remarkable. Indeed, under the circumstances, the loss to life and property reported is to be marvelled at because of its paucity, when the possibilities involved by his inconsiderate action are even thought of. From a superficial examination of the situation, made the day following the explosion, it would appear that the gas mains were well up and out of the way, leaving ample clearance between the bottoms of barrels of mains and the bottom of the trench for the placing of the conduit. But, supposing a main had been encountered in such position as to form a permanent obstruction to the laying of the conduit on the proposed alignment. Two ways exist in or by which to remove the apparent difficulty, without resorting to such reckless methods as seem to have obtained in this particular case. There are rights which everyone engaged on construction work are bound to observe. One of these is that when it becomes, or is considered, necessary to disturb the property of another party, that party should be communicated with so that its interest could be protected; but in the case under consideration the rights of the Gas Companies in the roadbed at Canal street and Broadway seem to have been ignored. Otherwise a competent representative would have been present to direct the Metropolitan Company's foreman in his direction of the excavating around and under a gas or other main. Again, supposing the main to have been a dead one, it would have cost nothing presumably to the Railway Company to have had it removed by the Gas Company, or to have received the latter's written statement that it was a dead one, with consent to its removal, thereby protecting itself to the full and enabling the Gas Company to see that the work was done properly and without injury to the live mains. The Metropolitan Street Railway Company is to be congratulated over the relatively small loss to life and property that was occasioned, and at the same time it should accept the lesson taught that it should in future notify those owners, whose property seems to form an obstacle to the satisfactory progress of its work, that such owners may have opportunity to save their property and at the same time assist the Railway Company's reckless contractors, or destructors."

MR. E. A. C. PEW and associates, of Toronto, Can., are said to be contemplating the construction of a "blast-coke" or a "coke-blast" furnace at Ottawa, Canada. Mr. Pew is not yet satisfied as to the orthodoxy of his plans, but, like Dr. Chisholm, he is satisfied that they are all right. Later on we suppose a word or two from Mr. John Coates, President of the Ottawa (Can.) Gas Company, will be in order.

THE authorities of Quincy, Ills., have closed a contract for the public lighting of that place with the Quincy Gas and Electric Light Company. We believe the contract is to last for a year from December 1st, but are unable to give any further particulars respecting it, our correspondent evidently believing that if we were told the contract was signed we could guess the rest.

A CORRESPONDENT incloses the following clipping, from the Grand Rapids (Mich.) *Democrat* of November 23d: "The Board of Directors of the Grand Rapids Gas Company gave a dinner of the complimentary sort to their Vice-President, Mr. Noyes L. Avery, in the ordinary of the Morton House, at 1 o'clock yesterday afternoon. Mr. Avery was one of the original stockholders in the old Grand Rapids Gas Light Company, and for many years was associated with the late Mr. Thomas D. Gilbert in its management. Covers were laid for 18: John Patton, Jr., Fred. Avery, Paul Doty, Wilder Stevens, Sydney Stevens, Henry B. Wales, George W. Thayer, John W. Champlin, C. D. Burch, Philo Fuller, Noyes L. Avery, H. D. Walbridge, James H. Barnett, Henry Idema, J. B. Pantlind, L. J. Rindge, A. G. Hodenpyl and T. J. O'Brien At the annual meeting of the Board of Directors of the Company, held last week, it was voted to tender the dinner to-day to Mr. Avery, who is the highest officer in the Company in the West."

A PROJECT for the establishment of a gas plant at Morris, Ills., is well underway. Its promoters are the people interested in the Morris electric light works.

A MEETING of the shareholders in the Laclede Gas Company, of St. Louis, Mo., has been called for the 24th prox. The subject for consideration will be a proposition to increase the capital stock from $10,000,000 to $11,000,000. A good part of the proceeds thus obtained, provided the scheme is ratified, will be devoted to the reconstruction of the works. Another part of the sum raised will go towards ameliorating the bonded indebtedness.

TOWARDS the close of last month the Common Council of New Rochelle, N. Y., which adjoins Mount Vernon on the east and south, granted a franchise to the Westchester Gas and Coke Company to operate a plant in the place named. The Westchester concern now holds a franchise for Mount Vernon, and its managers seem to be intimately acquainted with Mayor Fiske, of Mount Vernon, and with Mayor Dillon, of New Rochelle.

IT is conceded that the Pontiac (Mich.) Gas and Electric Company has succeeded to the gas and electric light properties of the L. R. Medbury Company, of Pontiac. The undertaking concern is capitalized in $100,000.

IT is reported that Messrs. F. H. Shelton and R. D. Apperson are looking for an opposition gas franchise for Lynchburg, Va. We thought Mr. Shelton had his hands quite busy in connection with certain gas interests in and about Philadelphia.

IT is whispered in Albany and Troy, N. Y., that Mr. A. N. Brady and his friends may have a chance to defend their undisputed possession of the gas and electric light supply of those cities. Turn about is fair play.

THE Decatur (Ills.) Gas and Electric Company has succeeded to the properties of the Decatur Gas Light and Coke Company, the Decatur Electric Company, and the Culver Electric Company. Mr. J. Manchester Haines is the moving spirit in the combination.

THE Butte (Montana) Gas Light and Coke Company has been incorporated by Messrs. A. J. Davis, W. L. Mayer, A. H. Barrett, W. L. Place and J. P. Odell. The Company is said to be capitalized in $300,000.

THE following is the text of an ordinance proposed for the inspection of gas meters by the authorities of Memphis, Tenn.:

Be it ordained by the legislative Council of the city of Memphis, That it shall be unlawful for any gas company to put in use in this city any new gas meter, unless said meter has first been tested by the gas inspector, and if found correct by the inspector he shall seal the meter and attach his stamp thereto. And no meter shall be put in use which shall have been discontinued, or which has been in use by any other consumer, unless the same has been reinspected and restamped by the inspector. And for inspecting, or reinspecting, sealing and stamping such meters the gas company shall pay to the inspector, for the use of the city, a fee of 50 cents for each meter inspected and stamped.

Sec. 2. Be it further ordained, That any gas company that shall violate the provisions of this ordinance shall be guilty of a misdemeanor, and shall be fined not less than $2 nor more than $50 for each and every offense.

Sec. 3. Be it further ordained, That it shall be unlawful for any person to counterfeit, mutilate or unlawfully deface the seal or stamp placed upon such meter sealed or stamped by the city gas inspector, and any person so offending shall be guilty of a misdemeanor and shall be fined not less than $2 nor more than $50 for each and every affense.

Engineering Record says that a 24-inch vitrified clay pipe main, on the New London (Conn.) water works, which has recently been replaced with cast iron after being in use 27 years, is somewhat novel. This main was laid in 1872, instead of cast iron, which at that time was very expensive, a distance of about 6,000 feet, and formed, until replaced, a part of the supply main to the city. It is laid along a plateau, being under from 21 to 18½ feet head. It is composed of vitrified fireclay, tile pipe in 3-foot lengths, the joints being made with concave wrought iron sleeves about 6 inches wide, filled with Rosendale cement mortar, the sleeves being sprung over the pipe and drawn together with bolts and the outside of the sleeves covered with cement mortar. The pipe was imported from Scotland, little if any being manufactured in this country at that time. Much difficulty has been experienced for several years from bursts on this main, and it was found that the sleeves in many places had corroded, usually on the bottom, and the pipe relieved of the support of the sleeves would split longitudinally. The split was usually straight, dividing a length of pipe in half, and repairs were made by bolting round iron bands about the pipe, drawing them tight enough to close the cracks. The breaks finally became so frequent as to require a new cast iron main, which was laid parallel to the old one last year. The pipe was designed by Col. J. T. Fanning, and the work was executed under the direction of the present engineer of the works, W. H. Richards.

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AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, DEC. 4, 1899.

The Market for Gas Securities.

Nothing particularly new came out last week in respect of the local gas situation. The matter of selling rates, at time of writing (noon last Friday), remains as before, with the New Amsterdam Company proclaiming the maximum legal rate at $1.10 per 1,000, and the Consolidated, Mutual and Standard Companies adhering to a charge of 65 cents. Consolidated sold to day at 192, ex div. of 1 per cent., payable the 15th. New Amsterdam common is quoted at 28 bid, the preferred being rated at 52 bid. While the ruling powers are the only ones that will know when the end is reached, it is beyond doubt that all surface indications point to speedy settlement.

Brooklyn Union is 139 ex div. of 3 per cent. Laclede common sold up sharply during the week. The opening in it to-day was 82 to 83. In our current item columns some mention will be found of the proposed rearrangement of its stock. Peoples, of Chicago, is in good demand, and continued inquiry is being made for Detroit gas.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

DEC. 4.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$39,078,000	100	192	192½
Central Union, Bonds, 5's.	3,000,000	1,000	107½	108½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	115	18
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	300	.
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
New Amsterdam Gas Co.	13,000,000	100	27½	28
Preferred	10,000,000	100	52	54
Bonds, 5's	11,000,000	1,000	96⅞	97
Northern Union, Bonds, 5's.	1,250,000	1,000	95	97
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	109	111
" 1st Con. 5's	1,500,000	..	112	114
Richmond Co., S. I.	348,650	50	70	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	112½	115
Preferred	5,000,000	100	140	.
Bonds, 1st Mortgage, 5's	1,500,000	1,000	112	114
Yonkers	299,65	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	138½	139
" " Bonds (5's)	15 000,000	1,000	118	119
Bay State	50,000,000	50	1¾	1⅞
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	40	..
" 1st Mtg. 5's	475,000	1,000	96½	99½
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	92	..
2d " " "	3,000,000	1,000	68	71
Buffalo City Gas Co.	5,500,000	100	9	11
" " Bonds, 5's	5,250,000	1,000	84	85
Central, San Francisco	2,000,000	..	105	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,207,000	1,000	106	108
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,090	1,000	102	105
Cincinnati G. & C. Co.	8,500,000	100	194	194½
Consumers, Toronto	1,700,000	50	230	235
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	11,000,000	100	55¼	55⅝
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	21	23
" Con. Mtg. 5's	380,000	1,000	87	90
Consolidated G. & E. Co.'s, Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,560,000	50	97	98
" Prior Lien 5's	4,598,000	1,000	99½	100
Detroit Gas Co., 5's	386,000	1,000	100	101
" Inc. 5's	16,000	100	100½	101
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	77	83
" Bonds	2,000,000	..	80	85
Grand Rapids Gas Lt. Co..	1,000,000	50	..	..
" 1st Mtg. 5's	1,125,000	1,000	..	..
Hartford	750,000	25	..	220
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	102	105
Indianapolis	2,000,000	..	122	128
" Bonds, 6's	2 650,000	..	105	106
Jackson Gas Co	250,000	50	72	78
" 1st Mtg. 5's	250,000	1,000	101	102½
Lafayette Gas Co., Ind.	1,000,000	100	68	70
Bonds	1,000,000	1,000	81	86
Louisville	2,570,000	50	106	108
Laclede, St. Louis	7,500,000	100	82	83
Preferred	2,500,000	100	94	100
Bonds	10,000,000	1,000	107	108
Madison Gas & Elec. Co.	400,000	100	82	85
" 1st Mtg. 6's	350,000	1,000	102½	108
Montreal, Canada	2,000,000	100	200	..
Newark, N. J., Gas Co	16,000,000	..	50	60
Bonds, 6's	4,600,000	..	107	108
New Haven	1,000,000	25	280	300
Nashville Gas Lt. Co.	1,000,000	50	110	..
Oakland, Cal.	2,000,000	..	53¾	55
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	113¾	114
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	30,100,000	1,000	111⅜	111½x
2d "	2,500,000	1,000	104	105
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	70	73
St. Paul Gas Light Co	1,500,000	100	57½	58½
1st Mortgage 6's	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,428,000	1,000	88	90½
St. Joseph Gas Co	1,000,000	100	42	44
" 1st Mtg. 5's	750,000	1,000	96½	98
Syracuse, N. Y.	1,750,000	100	15½	18
Bonds	1,612 000	1,000	81	84
Washington, D. C	2,600,000	20	285	..
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	100	103½	107½
Bonds, 5's	3,330,500	.	106	108
Wilmington, Del.	600,000		220	250

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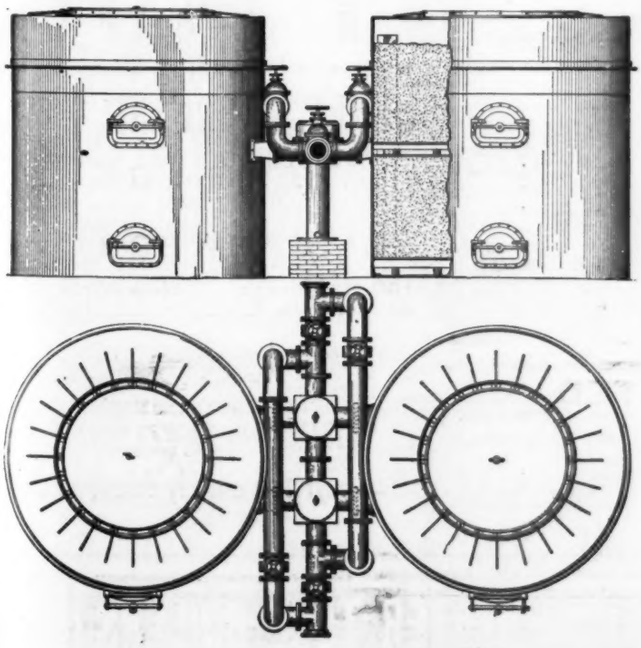

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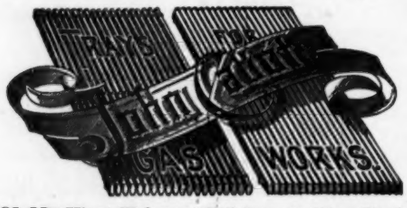

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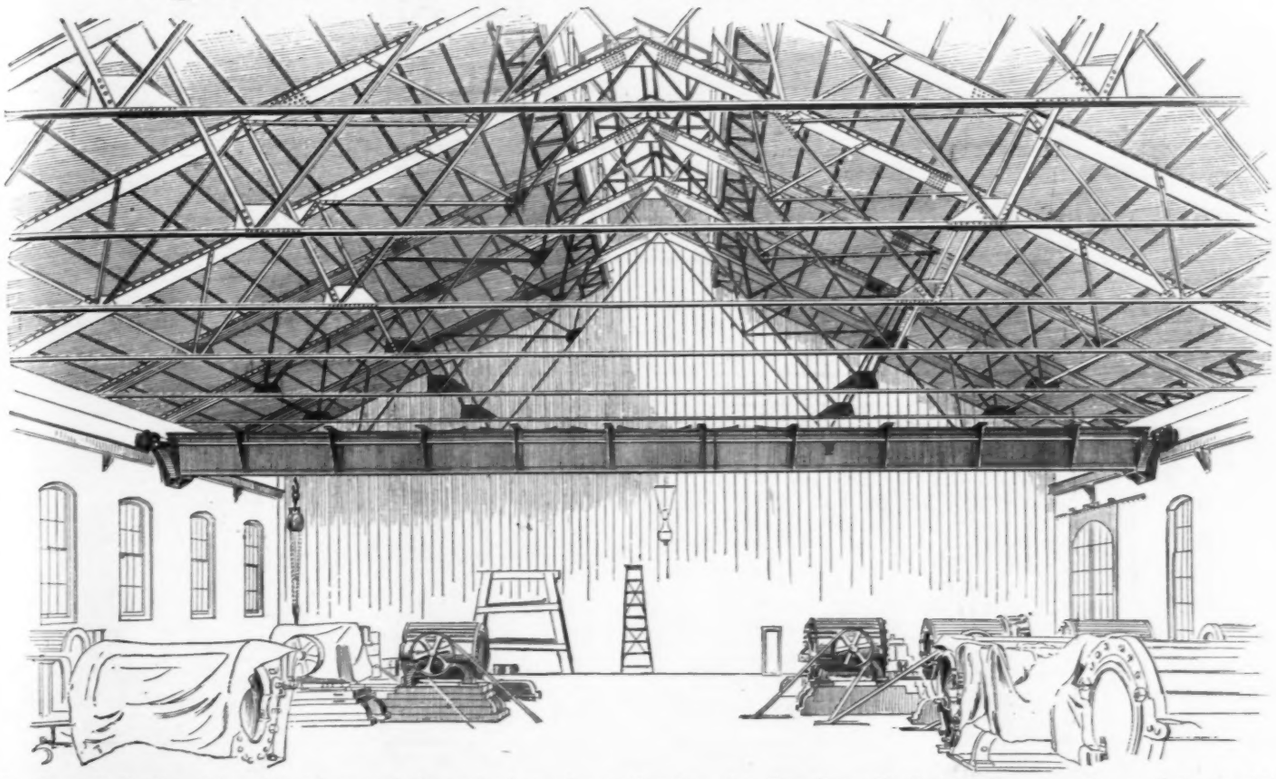

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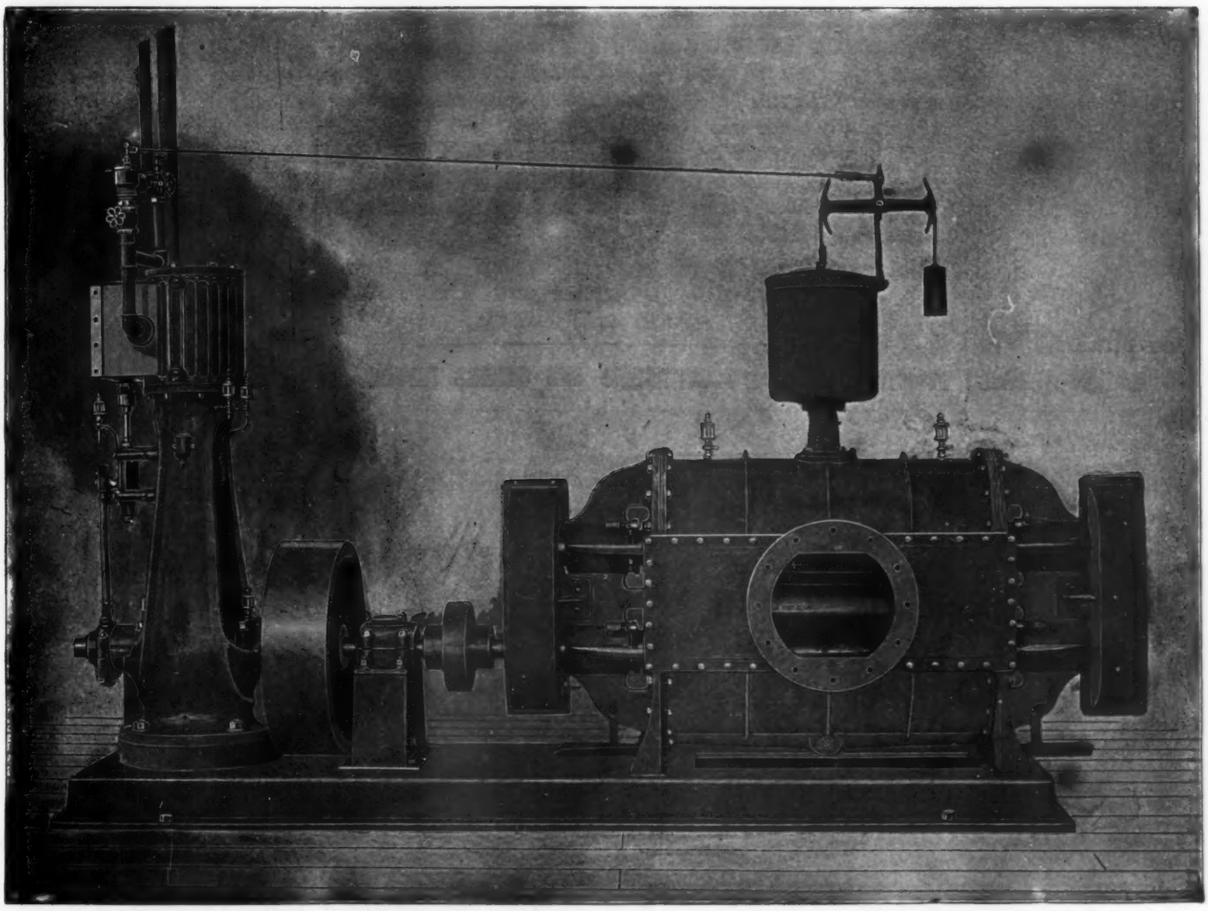

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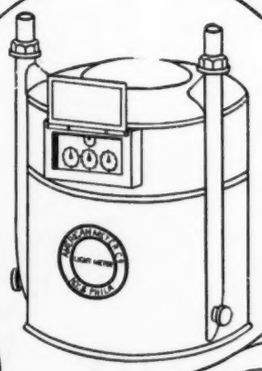
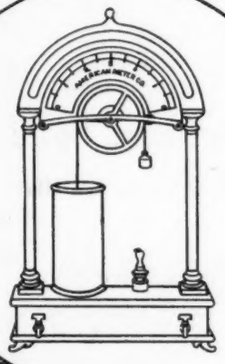
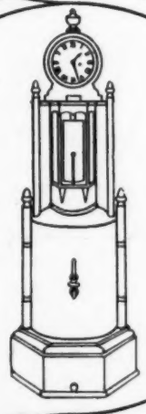
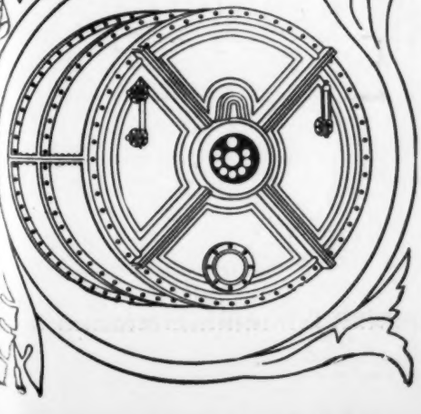








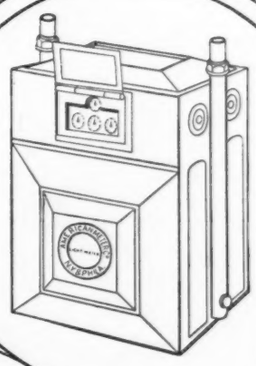
PUBLIC LIGHTING TABLE.

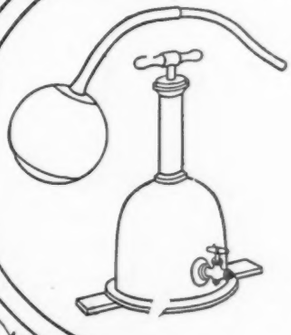
DECEMBER, 1899.

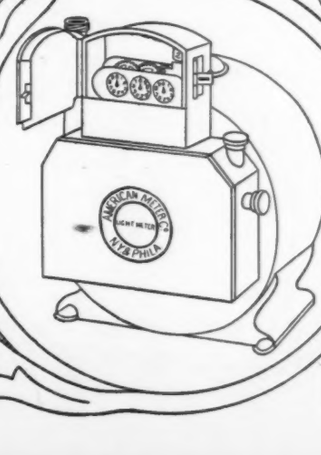
Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.	Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light.	Extinguish.
				P.M.	A.M.
Fri.	1	5.10 PM	6.00 AM	4.20	6.10
Sat.	2	5.10 NM	6.00	4.20	6.10
Sun.	3	5.00	6.10	4.20	6.15
Mon.	4	5.00	6.10	4.20	6.15
Tue.	5	5.00	6.10	4.20	6.15
Wed.	6	5.00	6.10	4.20	6.15
Thu.	7	8.50	6.10	4.20	6.15
Fri.	8	10.00	6.10	4.20	6.15
Sat.	9	11.10 FQ	6.10	4.20	6.15
Sun.	10	12.20 AM	6.10	4.20	6.20
Mon.	11	1.30	6.10	4.20	6.20
Tue.	12	2.40	6.10	4.20	6.20
Wed.	13	3 50	6.10	4.20	6.20
Thu.	14	4.50	6.10	4.20	6.20
Fri.	15	No L.	No L.	4.20	6.20
Sat.	16	No L. FM	No L.	4.20	6.20
Sun.	17	No L.	No L.	4.20	6.20
Mon.	18	5.10 PM	7.20 PM	4.20	6.20
Tue.	19	5.10	8.20	4.20	6.20
Wed.	20	5.10	9.20	4.20	6.20
Thu.	21	5.10	10.20	4.20	6.20
Fri.	22	5.10	11.20	4.20	6.20
Sat.	23	5.10	12.10 AM	4.20	6.20
Sun.	24	5.10 LQ	1.10	4.20	6.25
Mon.	25	5.10	2.10	4.20	6.25
Tue.	26	5.10	3.10	4.20	6.25
Wed.	27	5.10	4.20	4.20	6.25
Thu.	28	5.10	5.20	4.20	6.25
Fri.	29	5.10	6.20	4.20	6.25
Sat.	30	5.10	6.20	4.20	6.25
Sun.	31	5.10	6.20	4.20	6.25

TOTAL HOURS LIGHTING DURING 1899.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	215.40	January	423.20
February	184.40	February	355.25
March	187.40	March	355.35
April	166.50	April	298.50
May	158.00	May	264.50
June	140.50	June	234.25
July	150.30	July	243.45
August	168.30	August	280.25
September	179.50	September	321.15
October	213.20	October	374.30
November	217.00	November	401.40
December	238.10	December	433.45
Total, yr.	2221.00	Total, yr.	3987.45







Judge Townsend, Of United States Circuit Court,

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Welsbach Light Company

INJUNCTION AGAINST THE

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Doylestown, Pa.	1	50,000 "
Darby, Pa.	1	400,000 "
Adrian, Mich.	1	125,000 "
Concord, N. H.	1	400,000 "
Sioux City, Iowa	1	750,000 "
Standard Gas Light Co., New York	3	5,400,000 "
Peekskill, N. Y.	1	250,000 "
Westchester, N. Y.	1	250,000 "
Jersey City, N. J.	1	1,000,000 "
Stapleton, N. Y.	1	750,000 "
London, O.	1	125,000 "
Chicago, Ills.	2	3,600,000 "
Putnam, Conn.	1	125,000 "
Mansfield, O.	1	250,000 "
Plymouth, Pa.	1	125,000 "
Athens, Pa.	1	125,000 "
Charlotte, N. C.	1	250,000 "
Consolidated Gas Co., New York	2	2,000,000 "
Quincy, Ills.	1	250,000 "
Boone, Ia.	1	125,000 "
Webster, Mass.	1	50,000 "
Flushing, N. Y.	1	250,000 "
Total	29	18,650,000 "
Previously built	294	187,100,000 "
Grand Total	323	205,750,000 "

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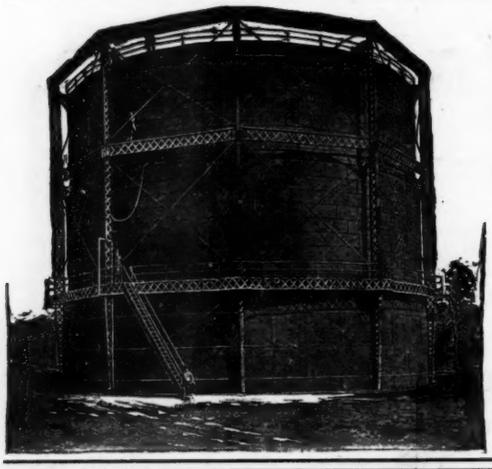

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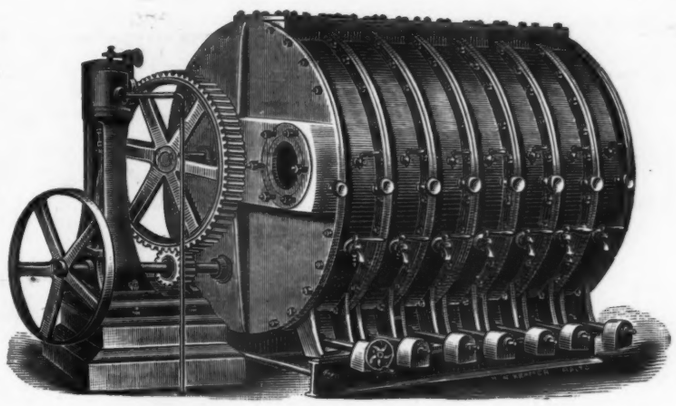

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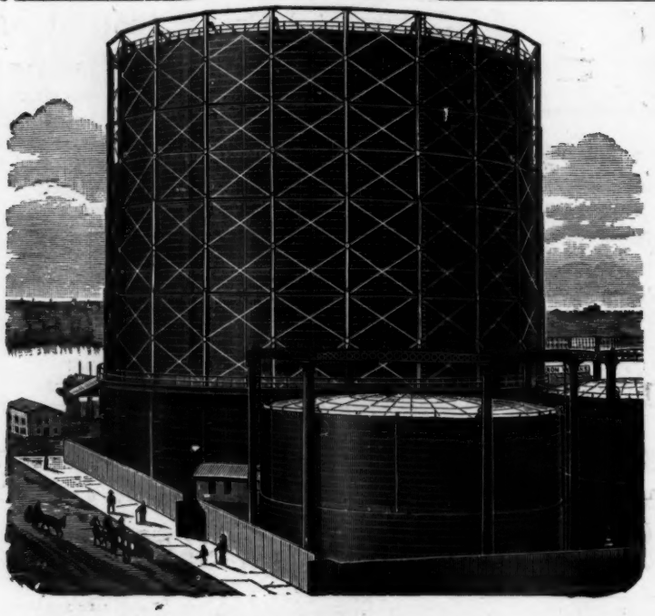

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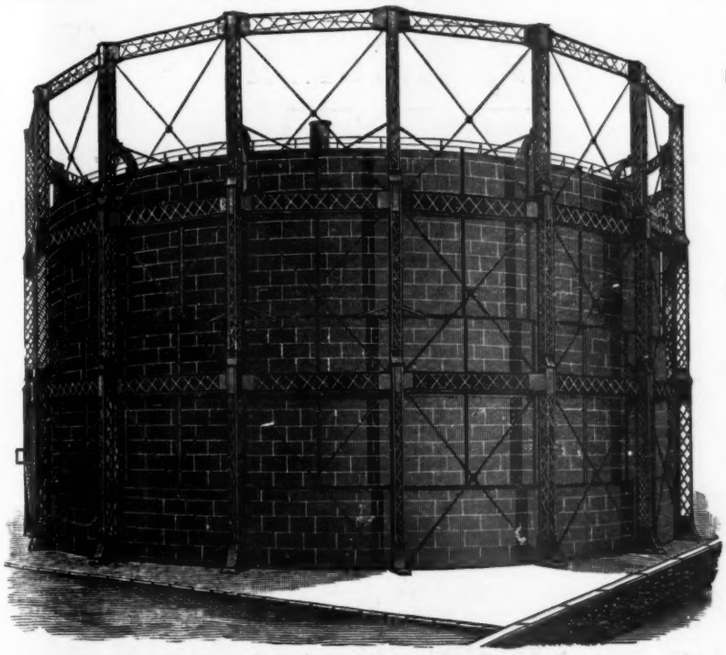

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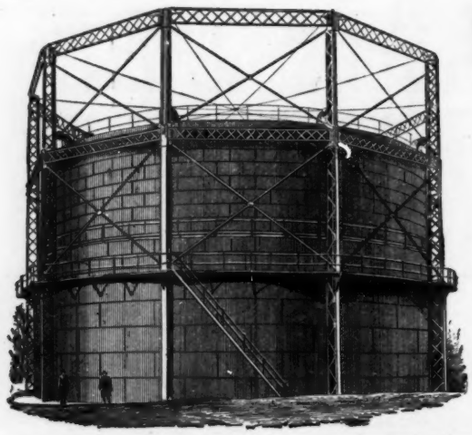

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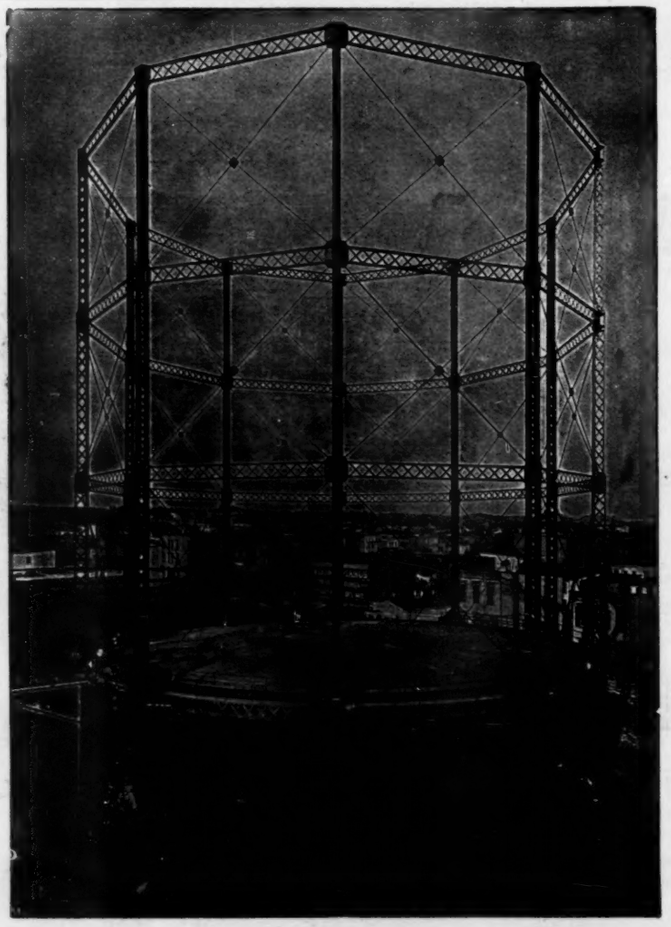

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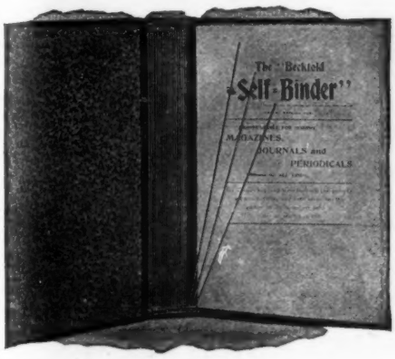

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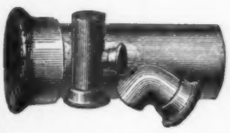

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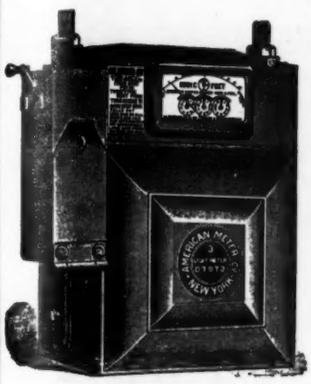

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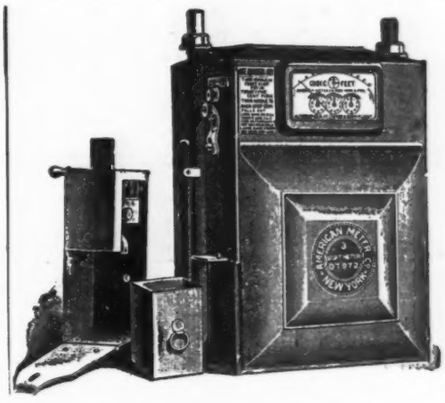

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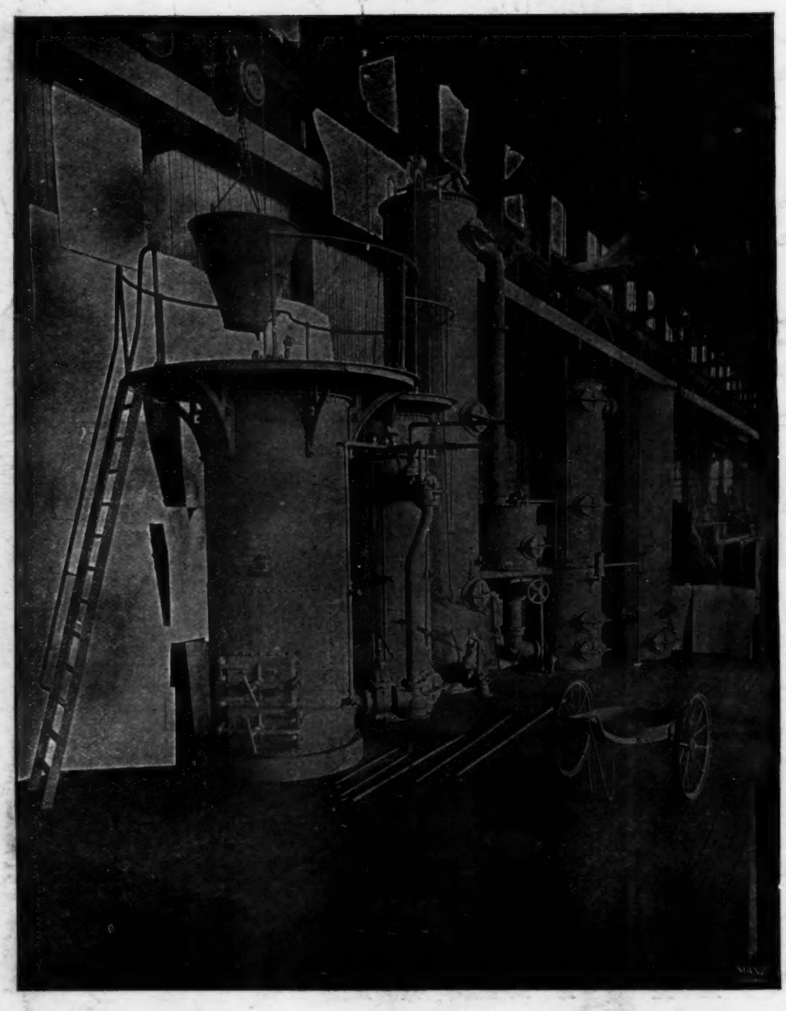

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